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SOLUTIA

Applied Chemistry, Creative Solutions

Solutia Inc.
575 Maryville Centre Drive
St. Louis, Missouri 63141

P.O. Box 66760
St. Louis, Missouri 63166-6760
Tel 314-674-1000

December 3, 1999
(Via Federal Express)

Mr. Kevin Turner
Environmental Scientist, OSC
U. S. Environmental Protection Agency
c/o 70 Cargill Elevator Road
Cahokia, IL 62206

Mr. Michael McAteer (SR-6J)
U. S. EPA - Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Steve W. Johnson
Geologist and Civil Engineer
U. S. EPA
DRT-14J
77 West Jackson Blv'd.
Chicago, ILL 60694-3590

Re: June 21, 1999 U. S. EPA UAO - Docket No. V-W-99-C-554
Dead Creek Culverts - Sauget Area I ("UAO")

Dear Mr. Turner, Mr. McAteer and Mr. Johnson,

Pursuant to the referenced UAO and as committed in Solutia's October 29, 1999 Response to U. S. EPA's ("EPA") September 24, 1999 letter to Solutia on the referenced UAO, enclosed is a cell design for on-site containment of the contaminated sediments from Sector B of Dead Creek.

Summarizing the background leading to this submittal, in its July 30, 1999 Response to the UAO, Solutia proposed the following Work elements for inclusion in the Order:

1. Reduce the potential for creek bank overflow

    1.1. Remove above grade vegetation in the creek bed between Route 3 and the Terminal Railway ROW.
    1.2. Remove and replace the culvert at Cargill Road.
    1.3. Remove the culvert and open a channel at the Terminal Railroad ROW

2. Address the contamination source

    2.1. Install facilities to pump water from Sector B to the American Bottoms Waste Treatment Plant (WTP) during periods of high flow conditions
    2.2. Remove contaminated sediments from Sector B and contain in an on-site double-lined containment cell.

In a September 24, 1999 response to Solutia, EPA took the following positions on these proposals:

- Items 1.1, 1.2 and 1.3 were approved for implementation without modification and no Work Plan was required. Planning for this work is now in progress.

- Item 2.1 was approved conceptually with a Work Plan required.

  Solutia responded to this item in an October 29, 1999 letter to EPA, recommending that pumping of the stormwater to the ABWTP and removal of the contaminated sediments from Sector B (Item 2.2) be evaluated and approved simultaneously.

- Item 2.2 was considered to be outside the scope of this UAO. EPA agreed with the idea in concept and felt that it may be an appropriate action under a different enforcement order.

  Solutia responded to this item in an October 29, 1999 letter to EPA, committing to a November 8 date for submittal of an evaluation of alternatives to an on-site containment cell for dealing with the contaminated sediments; to a December 3 date for submittal of an on-site containment cell design; and to negotiate with EPA, in good faith, an enforceable commitment to implement the on-site containment cell, to be performed either under this UAO or another order.

Therefore , pursuant to the need for timely action required by the UAO and consistent with its October 29, 1999 recommendations and commitment, Solutia submitted to EPA on November 8 an evaluation of alternatives to an on-site containment cell for dealing with the contaminated sediments, with the following conclusion:

> "On-site containment is a cost-effective remedy that can be implemented as a short-term removal action (< 6 months) or as a long-term remedy. It provides the same level of protection of public health and the environment as off-site incineration or off-site disposal at a significantly lower cost. In summary, on-site containment will meet the public's desire for action and will eliminate the potential for exposure to impacted sediments in a shorter time frame than either an off-site incineration removal action or an off-site disposal action."

Enclosed herewith is the on-site containment cell design as recommended in the October 29th correspondence. Per December 3, 1999 discussions with Mike McAteer, we plan to meet at the Sauget City Hall on December 14th at 10:00 AM to discuss the containment cell design; review Solutia's analysis of alternatives to on-site containment; and to discuss a draft enforcement order.

Sincerely,

D. M. Light
Manager, Remedial Projects
Solutia Inc.

cc: (w/o enclosure)

Mr. Thomas Martin, Esq. - USEPA
Ms. Candy Morin - IEPA

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BCC: (w/o enclosures)

Frank Miles - Office of Representative Jerry F. Costello
Brent Gilhousen, Esq. - Solutia
Joseph Nassif, Esq. - Thompson Coburn
Bruce Yare - 6S
Mike Foresman - 6S
Jim Hart - 1740
Robin Prokop - 4-N-370
James McDaniel - Ronan Potts
John Loper - SMCI
Kevin Cahill - 3N
Loren Wassell - 3N
Alan Faust - 1740

1.0 Introduction

Based on an evaluation of the factors identified in Section 300.415 of the National Contingency Plan (NCP) and attendant concerns for the risks to human health and the environment posed by sediments in Sauget Area 1 Creek Segment B and Site M, Solutia met with USEPA on October 19, 1999 to discuss implementation of a Time-Critical Removal Action to contain these sediments in an on-site, double-lined, TSCA-compliant cell constructed to RCRA minimum technology standards.

Solutia believes that a Time-Critical Removal Action is appropriate for the following reasons:

1) The threat of migration due to sediment mobilization and downstream transport during flood conditions. Sediments in Creek Segment B and Site M contain PCBs, Copper, Lead and Zinc with maximum concentrations of 17,000 ppm; 44,800 ppm; 24,000 ppm; and 71,000 ppm, respectively.

2) Although the culvert at the downstream end of Creek Segment B was blocked in 1965, the Village of Sauget has installed a high level overflow to mitigate flooding due to the plugged culvert. In addition, the Village has attempted to pump water from Creek Segment B to Creek Segment C to prevent flooding of residential areas and Judith Lane. These actions, taken to protect homes and transportation routes, create a threat of migration due to downstream movement of sediments during flood conditions.

3) An evaluation of the factors identified in Section 300.415 of the National Contingency Plan and attendant concerns for risks posed by sediments in Creek Segment B and Site M.

During the October 19th meeting, which was attended by representatives from Superfund and TSCA , Solutia obtained an understanding of the substantive requirements for a TSCA cell and made a commitment to the Agency to submit a containment cell design on December 3, 1999. URS Greiner Woodward Clyde was authorized to prepare a RCRA minimum technology design that would meet TSCA requirements on October 28, 1999. In addition, URS was authorized to undertake a foundation evaluation at the location of the proposed containment cell. Current plans call for constructing this cell immediately adjacent to the west bank of Dead Creek just south of Site G on property owned by Solutia.

At the October 19, 1999 meeting, the Agency requested that Solutia prepare an evaluation of three alternatives for handling sediment removed from Creek Segment B: 1) removal and off-site treatment at an incinerator in St. Ambroise, Quebec, 2) removal and off-site disposal at a RCRA/TSCA landfill in Detroit, Michigan and 3) removal and on-site containment. These off-site disposal facilities were identified by the USEPA as potential sites for receiving excavated sediments.

Solutia submitted a Removal Action Alternatives Evaluation to the Agency on November 8, 1999. This analysis concluded that:

> "On-site containment is a protective and cost-effective remedy that can be implemented as a short-term removal action or as a long-term remedy. An on-site containment removal action can be implemented faster than off-site incineration or off-site disposal removal actions. It provides the same level of protection of public health and the environment as off-site incineration or off-site disposal at a significantly lower cost:
>
> | | |
> |---|---|
> | Off-Site Incineration | $10,500,000 to $16,900,000 |
> | Off-Site Disposal | $8,000,000 to $10,000,000 |
> | On-Site Disposal | $2,000,000 to $2,500,000 |
>
> Risks associated with shipping 750 truck loads of PCB-containing sediments distances of 500 to 1,500 miles are eliminated by containing Creek Segment B sediments on site.
>
> The area adjacent to Creek Segment B has been historically used for waste disposal so construction of an on-site containment cell is consistent with historical land use. Local, state and federal elected officials do not object to construction of an on-site containment cell. Implementing an on-site containment removal action will demonstrate to the public that action is being taken after many years of study.
>
> In summary, on-site containment is a protective, cost-effective removal action that is acceptable to the public. An on-site containment removal action can be implemented quickly, will meet the public's desire for action and will eliminate the

> potential for human exposure to impacted sediments in a shorter time frame than either an off-site incineration removal action or an off-site disposal removal action. For these reasons, on-site containment is the preferred removal action for sediments in Creek Segment B and Site M."

Based on the conclusion of the Removal Action Alternatives Evaluation and in light of the factors identified in Section 300.415 of the NCP, Solutia prepared this TSCA Technical Requirements Compliance Demonstration. This document is intended to demonstrate that the containment cell, as designed, will: 1) meet TSCA technical requirements, 2) protect public health and the environment and 3) not cause an unreasonable risk to human health and the environment. A Containment Cell Design and a Site Geotechnical Investigation are included as Appendix A and B, respectively of this document.

2.0 Site Description

2.1 Dead Creek

Sauget Area 1, centered on Dead Creek and its floodplain, is located in the Villages of Sauget and Cahokia, St. Clair County, Illinois. Dead Creek, an intermittent stream, runs approximately 17,000 feet from its upstream end at Queeny Avenue in Sauget, Illinois to its downstream end at Old Prairie Dupont Creek in Cahokia, Illinois. IEPA divided the creek into six segments during a 1988 site investigation (Figure 1):

Creek Segment A	Alton & Southern Railroad to Queeny Avenue
Creek Segment B	Queeny Avenue to Judith Lane
Creek Segment C	Judith Lane to Cahokia Street
Creek Segment D	Cahokia Street to Jerome Lane
Creek Segment E	Jerome Lane to Route 157
Creek Segment F	Route 157 to Old Prairie du Pont Creek

Creek Segment B (CS-B) extends for approximately 2000 ft. from its northern, upstream end at Queeny Avenue to its southern, downstream end at Judith Lane. In 1965, the culvert at the southern end of CS-B (Judith Lane) was blocked to prevent downstream flow of water.

2.2 Source Areas

Waste disposal was a common land use throughout the history of Sauget Area 1. Six source areas exist in the headwaters of Dead Creek: Site G, Site H, Site I, Site L, Site M and Site N (Figure 1). Site I, a closed municipal/industrial landfill is located in Creek Segment A. Sites G, H, L and M are located in Creek Segment B. Site G is a closed uncontrolled disposal area stabilized and covered by EPA in a 1995 response action. Site H is a closed municipal/industrial landfill. Site L is a backfilled wastewater impoundment. Site M, a former borrow pit, is an impoundment hydraulically connected to Dead Creek through an eight-foot wide opening in its southwestern corner. Site N, located in Creek Segment C, is a backfilled borrow pit.

Wastes in these source areas, which operated from the 1930s to the 1980s, came from a wide variety of municipal and industrial sources. Current Agency estimates indicate that these sites have an area of more than 30 acres and a volume in excess of 400,000 cubic yards.

2.3 Land Use

During recent years land use has been consistent in the area surrounding Dead Creek. In a 1988 report prepared for IEPA (Expanded Site Investigation, Dead Creek Project Sites at Cahokia/Sauget, Illinois), Ecology and Environment indicated that "A wide variety of land utilization is present [in the study area]. The primary land use in the town [village] of Sauget is industrial, with over 50% of the land used for this purpose. Small residential, commercial, and agricultural properties are also interspersed throughout the town [village]. Significant land use features, in relation to individual project sites will be discussed below.

Land surrounding the Area 1 project sites is used for several purposes. A small residential area is located immediately east of Sites H and I, across Falling Springs Road. The nearest residence is approximately 200 feet from these sites. The Sauget Village Hall is also located on top of, or adjacent to, Site I .... South of Sites G and L are two small cultivated fields which are used for soybean production. These fields separate the sites from a residential area in the northern portion of Cahokia. Several small commercial properties are also found in the immediate vicinity of the Area 1 sites." These land use patterns are typical of Dead Creek east of its intersection with Route 3 (Mississippi Avenue). Immediately south of Route 3 there is a residential area. After this developed area, Dead Creek runs through undeveloped area until it reaches the lift station at Old Prairie du Pont Creek.

Land use surrounding CS-B is primarily commercial and agricultural. Commercial land use occurs along Route 3 (Mississippi Avenue), Queeny Road and Falling Springs Road. Undeveloped land is used for agriculture with soy beans and winter wheat being the primary crops. A small residential area of approximately 20 homes is located on Walnut Street and Judith Lane in the southeastern corner of this creek segment.

2.4 Climate

Geraghty and Miller, in a report prepared for Monsanto (Site Investigation for Dead Creek Segment B and Sites L and M, Sauget-Cahokia, Illinois, 1992), indicates that "The climate of the site(s) is continental with hot, humid summers and mild winters. Periods of extreme cold are short. The average annual rainfall in the area for the period from 1903 to 1983 was 35.4 inches, however, precipitation increased to 39.5 inches per year during the period between 1963 and 1988. The average annual temperature is 56°F; the highest average monthly temperature (79 °F) occurs in July and the lowest average monthly temperature (32 °F) occurs in January."

2.5 Hydrology

According to Ecology and Environment (1988) "the project area lies in the floodplain, or valley bottom, of the Mississippi River in an area known as the American Bottoms. For the most part the topography consists, of nearly flat bottom land, although many irregularities exist locally across the site areas.... Generally, the land surface in undisturbed areas slopes from north to south, and from the east toward the river. This trend is not followed in the immediate vicinity of [Sauget Area 1]. Elevations of Area 1 sites range from 410 to 400 feet above mean sea level (MSL) ... Little topographic relief is exhibited across individual sites, with the exception of Sites G ... Dead Creek serves as a surface water conduit for much of the Sauget and Cahokia area. The creek runs south and southwest through these towns [villages] to an outlet point in the [O]ld Prairie Du Pont [sic] Creek floodway, located south of Cahokia. The floodway in turn discharges to the Cahokia Chute of the Mississippi River."

2.6 Geology

Geraghty and Miller (1992) described site geology as follows "The site(s) is situated on the floodplain of the Mississippi River. The floodplain is locally named the American Bottoms and contains unconsolidated valley fill deposits composed of recent alluvium (Cahokia Alluvium), which overlies glacial material (Henry Formation). Published information indicates that these unconsolidated deposits are underlain by bedrock of Pennsylvanian and Mississippian age consisting of limestone and dolomite with lesser amounts of sandstone and shale.

The Cahokia Alluvium (recent deposits) consists of unconsolidated, poorly sorted, fine-grained materials with some local sand and clay lenses. These recent alluvium deposits unconformably overlie the Henry Formation which is Wisconsinian glacial outwash in the form of valley train deposits. The Henry Formation is about 100 feet thick. These valley-train materials are generally medium to coarse sand and gravel and increase in grain size with depth."

2.7 Water Resources

Domestic Water Supply - Ecology and Environment (1988) conducted an evaluation of groundwater and surface water resources and the results of this evaluation are summarized below.

"The primary source of drinking water for area residents is an intake in the Mississippi River. This intake is located at river mile 181, approximately 3 miles north of the DCP [Dead Creek Project] study area. The drinking water intake is owned and operated by the Illinois American Water Company (IAWC) of East St. Louis, and it serves the majority of residences in the DCP area. IAWC supplies water to ... Sauget .... The Commonfields of Cahokia Public Water District purchases water from IAWC and distributes it to portions of Cahokia and Centerville Township. The Cahokia Water Department also purchases water from IAWC and distributes it to small residential areas in the west and southwest portions of Cahokia.

A review of IDPH and ISGS files indicated that at least 50 area residences [within a 3 mile radius of the site] have wells which are used for drinking water or irrigation purposes. These wells are located in Cahokia (23) ....The nearest private wells to any of the DCP sites are located on Judith Lane, immediately south of the Area 1 sites. Based on interviews with these well owners, only one of the five wells located in this area is used occasionally as a source of drinking water and the other four are never used for this purpose."

Industrial Water Supply - Ecology and Environment (1988) also described industrial water usage. "Industrial groundwater usage has been very extensive in the past. Peak use occurred in 1962 when groundwater pumpage exceeded 35 million gallons per day (mgd). Relatively few industries utilize well-supplied groundwater for process or cooling water. Total groundwater pumpage from industrial sources in the project area [3 mile radius] is estimated to be less than 0.5 mgd." [Note: Groundwater usage is probably even lower today given the decline in the region's industrial base.]

Downstream Surface Water Intakes - Ecology and Evironment (1988) indicated that "the nearest downstream surface [water] intake on the Illinois side of the Mississippi River is located at river mile 110, approximately 64 miles south of the project area. This intake supplies drinking water to residents in the Town of Chester and surrounding areas in Randolf County, Illinois. The nearest potentially impacted public water supply on the Missouri side of the river is located at river mile 149, approximately 28 miles south of the DCP area. The Village of Crystal City, Missouri (pop. 4,000) located 28 miles south of the DCP area, utilizes a Ranney well adjacent to the Mississippi River as a source for drinking water. Although this is not actually a surface water intake, it is assumed that the well draws water from the river due to its construction and location adjacent to the river."

Agricultural Water Supply - Ecology and Evironment (1988) reported that "Although agricultural land is found throughout the immediate project area, this land is apparently not irrigated. The nearest irrigated land, other than residential lawns and gardens, is located in the Schmids Lake-East Carondelet area [south of Old Prairie du Pont Creek which is the end of Sauget Area 1]."

3.0 Analytical Data Summary

In 1998 Ecology and Environment, at the request of the Agency, compiled all existing analytical data for Dead Creek (Volume 1, Sauget Area 1 Data Tables/Maps, February 1998). Maximum detected constituent concentrations for CS-B and Site M sediment and soil reported in this document are given below:

VOCs (parts per million)	
Acetone	5
Benzene	<1
2-Butanone	14
Carbon Disulfide	<1
Chlorobenzene	13
Ethylbenzene	4
4-Methyl-2-Pentanone	<1
Tetrachloroethane	<1
Toluene	5
Xylene	<1

PCBs (parts per million)	
PCBs	17,000

SVOCs (parts per million)	
Acenapthene	3
Acenaphthylene	<1
Alkylbenzene	<1
Anthracene	4
Benzo(a)anthracene	9
Benzo(b)fluoranthene	30
Benzo(k)fluoranthene	15
Benzo(g,h,l)perylene	13
Benzo(a)pyrene	10
Bis(2-ethylhexyl)phthalate	18
Butylbenzylphthalate	2
Chrysene	12
Chloronitrobenzene	240
2-Chlorophenol	<1
Dibenzo(a,h)anthracene	4

Metals/Inorganics (parts per million)		SVOCs (parts per million)	
Antimony	45	Dibenzofuran	2
Arsenic	306	1,2-Dichlorobenzene	12,000
Barium	17,300	1,3-Dichlorobenzene	4
Beryllium	3	1,4-Dichlorobenzene	220
Boron	76	2,4-Dichlorophenol	<1
Cadmium	400	Di-n-butyl phthalate	<1
Chromium	400	Di-ni-octyl phthalate	3
Cobalt	100	2,4-Dimethylphenol	<1
Copper	44,800	Fluoranthene	21
Lead	24,000	Fluorene	6
Mercury	30	Hexachlorobenzene	2
Nickel	3,500	Indeno(1,2,3-cd)pyrene	9
Selenium	602	Isophorone	<1
Silver	100	2-Methylnapthalene	8
Strontium	430	4-Methylphenol	<1
Thallium	4	Napthalene	10
Tin	32	4-Nitrophenol	3
Vanadium	100	Pentachlorophenol	2
Zinc	71,000	Phenanthrene	15
Cyanide	4	Pyrene	27
		1,2,4-Trichlorobenzene	3,700
		1,2,4-Trichlorophenol	5
		2,4,5-Trichlorophenol	<1
		2,4,6-Trichlorophenol	<1

80% (8 of 10) of the VOC maximum concentrations are between <1 and 10 ppm and two (20%) are between 10 and 20 ppm. SVOC maximum concentrations are grouped as follows: 26 of 39 (67%) between <1 and 10 ppm, 6 of 39 (15%) between 11 and 20 ppm, 3 of 39 (8%) between 21 and 50 ppm and 4 of 39 (10%) greater than 100 ppm. Metals maximum concentration distributions are 5 of 20 (25%) between 1 and 50 ppm, 5 of 20 (25%) between 51 and 100 ppm, 5 of 20 (25%) between 101 and 1,000 ppm and 5 of 20 (25%) greater than 1000 ppm.

Using organic concentrations of greater than 100 ppm and metals concentrations of greater than 1,000 ppm as a basis for focusing on constituents with the highest detected concentrations, the following summary statistics result:

	Maximum Concentration	95th Confidence Interval	Arithmetic Mean	Geometric Mean	Minimum Concentration
Organics (ppm)					
PCBs	17,000	5,200	9,706	108	<1
1,2-Dichlorobenzene	12,000	9,675	1,367	10	<1
1,2,4-Trichlorobenzene	3,700	1,679	342	11	<1
Chloronitrobenzene	240	236	203	201	170
Inorganics (ppm)					
Zinc	71,000	53,350	14,126	5,047	30
Copper	44,800	36,050	11,186	2,890	27
Lead	24,000	2,795	1,313	319	6
Barium	17,300	8,578	2,400	1,089	41
Nickel	3,500	3,000	937	367	12

4.0 Sediment Volume

4.1 Creek Segment B

Monsanto evaluated removal of sediment from Creek Segment B in 1991/1992. As part of this evaluation, sediment volume was estimated by assuming an average channel bottom width and sediment depth of 20 ft and 2 ft, respectively. For a stream length of 1600 ft., the estimated sediment volume was 4,000 to 4,500 tons. This translates to 2,700 to 3,000 cubic yards using a conversion factor of 1.5 tons per cubic yard.

Recalculating to verify this estimate yields a sediment weight of 3,555 tons:

$$\begin{aligned} \text{Volume} &= 1600 \text{ ft } (20 \text{ ft})(2 \text{ ft}) \\ &= 64{,}000 \text{ ft}^3 \\ &= 2{,}370 \text{ yd}^3 \end{aligned}$$

$$\begin{aligned} \text{Weight} &= 2{,}370 \text{ yd}^3 \ (1.5 \text{ tons/ yd}^3) \\ &= 3{,}555 \text{ tons} \end{aligned}$$

The difference between this verification calculation and the 4,000 to 4,500 volume estimate included in the 1991/1992 Monsanto estimate is probably due to rounding up the volume to account for uncertainties in the channel width and depth assumptions.

The northern 400 ft. of CS-B was not included in the Monsanto estimate because access could not be obtained for this portion of the drainage channel. Estimated volume and weight for this stretch, using the 1991/1992 estimate assumptions, are:

$$\begin{aligned} \text{Volume} &= 400 \text{ ft } (20 \text{ ft})(2 \text{ ft}) \\ &= 16{,}000 \text{ ft}^3 \\ &= 593 \text{ yd}^3 \end{aligned}$$

$$\begin{aligned} \text{Weight} &= 593 \text{ yd}^3 \ (1.5 \text{ tons/ yd}^3) \\ &= 890 \text{ tons} \end{aligned}$$

With the 1991/1992 estimating methodology, the total estimated volume of sediment in CS-B is 2,963 yd^3 and the total estimated weight is 4,445 tons.

4.2 Site M

In 1991/1992 Monsanto also estimated the volume of sediment in Site M to be 3,800 yd^3 with a weight of 5,000 tons. To verify this estimate, an average sediment thickness of 1.6 feet was calculated from Site M sediment thickness measurements included in the 1991 Geraghty and Miller report "Site Investigation for Dead Creek Sector B and Sites L and M, March 1992". With this average sediment thickness, the estimated sediment volume in Site M is:

$$\begin{aligned} \text{Volume} &= 59{,}200 \text{ ft}^2 \ (1.6 \text{ ft}) \\ &= 94{,}720 \text{ ft}^3 \\ &= 3{,}508 \text{ yd}^3 \end{aligned}$$

$$\begin{aligned} \text{Weight} &= 3{,}508 \text{ yd}^3 \ (1.5 \text{ tons/ yd}^3) \\ &= 5{,}262 \text{ tons} \end{aligned}$$

This analysis verifies the original sediment volume and weight estimates for Site M.

4.3 Time-Critical Removal Action Volume

Based on work done by Monsanto in 1991/1992 the total estimated volume of sediment in CS-B and Site M is 6,493 yd^3 with a total estimated weight of 9,445 tons. For planning purposes, the estimated volume of sediments in CS-B and Site M is 10,000 cubic yards with a weight of 15,000 tons.

4.4 Sediment Removal

Current plans call for removing sediments from Creek Segment B and Site M by working in the dry during a low precipitation period, e.g. July and August 2000. Storm water will be diverted around Creek Segment B work areas using temporary berms, sheet piling or similar diversion structures or it may be pumped around these work areas. Runoff from disturbed work areas will be treated to remove suspended solids, if necessary, prior to discharge to the American Bottoms POTW.

Site M will be hydraulically isolated from Dead Creek by closing the opening between Creek Segment B and the southwestern corner of Site M using compacted soil, sheet pile or other suitable method. Impounded water will be pumped to the American Bottoms POTW. If necessary, this water will be treated to remove suspended solids. Groundwater recharge may prevent removal of impounded water from Site M without special measures such as cutoff walls or groundwater dewatering systems. If this occurs, the Site M sediment removal action will be terminated unless the time required to design and implement a cost-effective groundwater inflow control system is significantly less than the time required by Solutia to complete the EE/CA Report for soil, sediment, surface water and air and for the Agency to issue an action memorandum based on this report.

If too much H_2O.... then what are the??? options.

Once sediments are removed from Creek Segment B and Site M, they will be dewatered, if necessary, using one or more of the following dewatering methods:

- In-Situ Gravity Dewatering
- In-Situ Solidification
- On-Site Gravity Dewatering
- On-Site Solidification

Dewatered sediments will pass the Paint Filter Test in the containment cell. It may be necessary to add a solidifying agent during compaction of the sediments in the containment cell in order to achieve this performance criterion.

5.0 TSCA Technical Requirements Compliance Demonstration

This TSCA Technical Requirements Compliance Demonstration is intended to demonstrate compliance with the substantive requirements of Section 761.61(b) Performance-Based Disposal Regulations and Section 761.75 Technical Requirements for a Chemical Waste Landfill. Solutia's proposed containment cell (Appendix A) is designed to ensure that on-site containment of impacted sediments removed from Creek Segment B and Site M is protective of public health and the environment and will not cause unreasonable risk. Specific technical measures are included in the design to address risks associated with:

- Shallow Groundwater
- Groundwater Usage
- Leachate Migration
- Flooding
- Stormwater

These technical measures are discussed below.

5.1 Shallow Groundwater

Depth to groundwater at the site of the proposed containment cell ranges from 10 to 15 feet below ground surface. To mitigate risks associated with a depth to groundwater of less than 50 feet, a double-lined containment cell will be built above grade on three feet of clay compacted to achieve a permeability of 1×10^{-7} cm/sec. The cell will have a primary liner system with a leachate collection system and a secondary liner system with a leak detection system. Accumulated leachate will be removed regularly to minimize hydraulic head on the primary liner system. Three barriers will prevent any leachate generated in the containment cell from reaching the shallow water table: 1) the primary 60 mil HDPE liner and leachate recovery system, 2) the secondary 60 mil HDPE liner and leak detection system and 3) the three ft. thick, 1×10^{-7} compacted clay soil at the base of the cell.

A Granular Clay Liner (GCL) may be used instead of three feet of compacted clay if it is cost-effective and if an equivalency demonstration can be completed in the six month planning period for a Time-Critical Removal Action.

5.2 Groundwater Usage

Sauget and Cahokia are served by a public water supply system that obtains surface water from a Mississippi River intake located approximately three miles upstream of the proposed containment cell location. Groundwater is not used as a drinking water or industrial water supply source in Cahokia or Sauget. In fact, the Village of Sauget prohibits the use of groundwater as a water supply source. None of the industries in the vicinity of the site, Big River Zinc, Ethyl Corporation, Solutia and Cerro Copper, use groundwater.

Ten private wells are located within a mile of the proposed containment cell. Four of the five closest wells, located in a residential area approximately 1000 feet south of cell, were sampled as part of the Sauget Area 1 Support Sampling Plan (SSP) and the samples are currently being analyzed. The SSP is an EE/CA and RI/FS investigation currently being conducted by Solutia

data

under an AOC with the Agency. Conversations with the well owners during sampling indicate that water from these wells is used for lawn watering only. Drinking water is obtained from the public water supply system.

Since groundwater is not used as a water supply source, specific technical design measures are not needed to mitigate risks associated with groundwater use. If groundwater were used as a water supply source, technical measures taken to control risks associated with the shallow water table (described above) and leachate migration (described below) would also control risks associated with groundwater usage. ??

5.3 Leachate Migration

A number of technical measures are included in the design to mitigate risks associated with leachate migration: 1) containing dry solids (contained sediments will pass the Paint Filter Test) Good how often tested and not liquids, thereby preventing catastrophic release of liquids, 2) containing dewatered sediments in a double-lined cell, 3) building the double-lined cell above grade and 4) placing the above-grade cell on top of three feet of clay compacted to achieve a permeability of 1x10-7 cm/sec..

What exactly is this system

The cell will have a 60 mil, HDPE primary liner system with a leachate collection system and a 60 mil, HDPE secondary liner system with a leak detection system. HDPE is compatible with PCBs. Any leachate draining from the fill will be collected and removed by the leachate collection system. Should the primary liner be breached, the secondary liner and leak detection system will allow collection and removal of leachate. Should the secondary liner system fail, the compacted clay base, with a permeability 1x10-7 cm/sec, will act as an additional leachate migration barrier. Building the containment cell above grade will also mitigate the impact of any leachate migration because leachate will preferentially move horizontally when it encounters the low-permeability compacted clay base. Should it move vertically into and through the low-permeability compacted clay base, the surficial fine-grained soils underlying the site will retard downward movement.

If leachate should reach the water table and migrate through the groundwater system, it will be detected in a timely fashion using monitoring wells. Appropriate responses will be initiated on detection. There are no downgradient groundwater users. Any impacted groundwater migrating beyond the site boundary would discharge to the Mississippi River which is about one mile west of the site.

5.4 Flooding

The proposed containment cell is not in a FEMA 100-year floodplain, however, it is located in the floodplain of the Mississippi River. Construction in a floodplain to improve environmental conditions is allowed by Executive Order. In addition, a floodwall and levee system, constructed by the US Army Corps of Engineers (USACE), protects the site from flooding. During the July 1993 flood, the largest recorded flood in St. Louis history, the Corps' flood protection system performed as designed and prevented the site of the proposed containment cell from being flooded. Site R, a closed and capped landfill in Sauget Area 2 outside the floodwall, was inundated during the 1993 flood. Floodwaters reached to just below the top of its vegetated clay cap and the side slopes survived intact as the water receded.

To mitigate the risk of flooding due to failure of the floodwall and levee system and/or failure of the lift station at the downstream end of Dead Creek, the containment cell will be built with flat and/or gravel-armored slopes that will not erode as flood waters recede. To prevent the cap from floating during inundation, trapped air will be vented and/or the cap will be weighted with a gravel cover.

and collected ??

5.5 Stormwater

Stormwater runoff will be routed to downchutes designed to handle flow from a 25 year, 24 hour storm.

6.0 Summary

This TSCA Technical Requirements Compliance Demonstration describes the technical measures that will be taken to ensure that the proposed Creek Segment B and Site M on-site sediment containment cell is protective of public health and the environment and will not cause unreasonable risk. Specific technical measures incorporated in cell design include:

- Above grade construction
- Construction to RCRA minimum technology standards
- Construction on a three ft. thick, $1X10^{-7}$ cm/sec clay base
- Double lined cell
- 60 mil HDPE membranes
- Sand and/or gravel leachate collection system above primary liner
- Geosynthetic leak detection system above secondary liner
- Groundwater monitoring to detect leachate migration
- Slopes designed to resist erosion as flood waters recede
- Gravel armoring of potentially flooded slopes
- Gravel cover to resist floating during flooding or air venting to prevent floating during flooding

These risk mitigation measures will ensure that the proposed on-site containment cell is protective of public health and the environment and does not cause unreasonable risk due to shallow groundwater, leachate migration, flooding or stormwater. No risks are associated with groundwater usage because groundwater is not used as a water supply source. If it were, the technical measures described above would ensure that the proposed on-site containment cell does not cause unreasonable risk to public health and the environment due to groundwater usage.

Figures

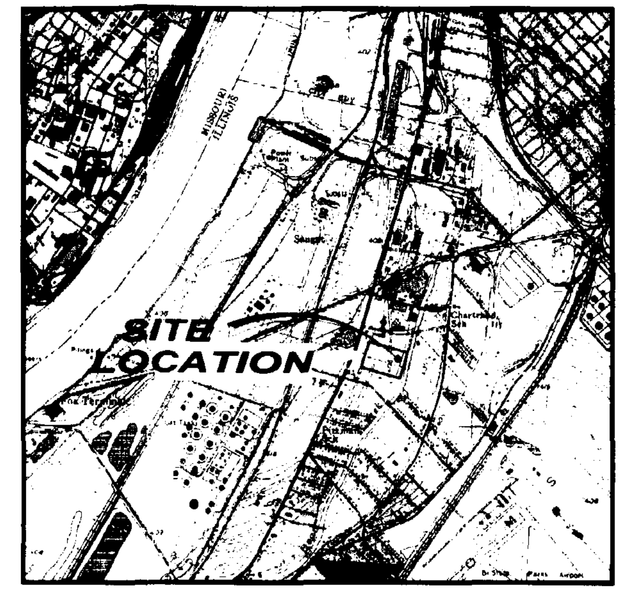
Appendix A

Containment Cell Design

CONSTRUCTION PLANS FOR SAUGET AREA 1 TSCA LANDFILL CAHOKIA, ILLINOIS

SITE LOCATION

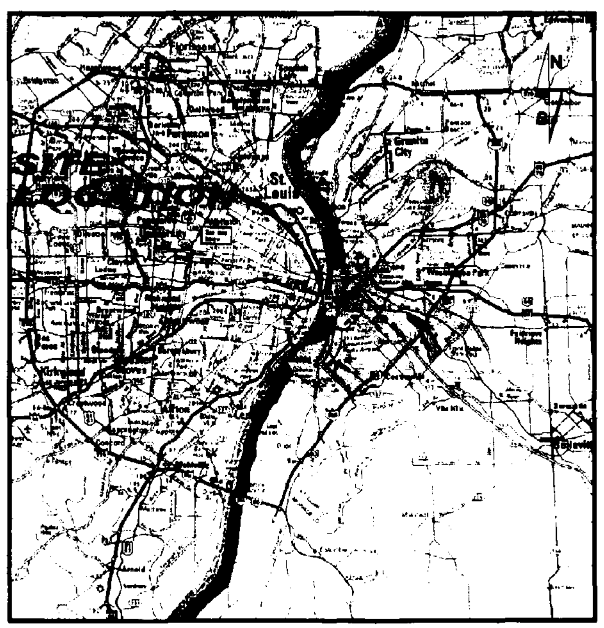
ILLINOIS MAP



PROJECT VICINITY MAP

SOLUTIA™

Applied Chemistry, Creative Solutions



SITE LOCATION MAP

90% DESIGN

CERTIFICATION

ENGINEER: ______________ DATE: ________ REG. NO. ________

NOT FOR CONSTRUCTION
FOR AGENCY REVIEW ONLY.

INDEX OF DRAWINGS

P. CARTWRIGHT R:\SOLUTIA\SAUGET\COVER.DWG 12/01/99 08:47

REV	DESCRIPTION OF REVISION	BY	DATE

DESIGNED BY: MB/GW
DRAWN BY: B. DOUGLAS
CHECKED BY: P. CARTWRIGHT
PROJECT MANAGER: G. WANTLAND
DATE: DECEMBER 3, 1999

URS Greiner Woodward Clyde
7650 WEST COURTNEY CAMPBELL CSWY.
TAMPA, FLORIDA 33607-1462
TEL: 813.286.1711 FAX: 813.287.8591

SOLUTIA INC.
SAUGET AREA 1
CAHOKIA, ILLINOIS

COVER SHEET

PROJECT NUMBER
C100003899.00

SHEET
G1.1

REV	DESCRIPTION OF REVISION	BY	DATE

DESIGNED BY: C. WANTLAND
DRAWN BY: B. DOUGLAS
CHECKED BY: P. CARTWRIGHT
PROJECT MANAGER: C. WANTLAND
DATE: DECEMBER 3, 1999

URS Greiner Woodward Clyde
7650 WEST COURTNEY CAMPBELL CSWY.
TAMPA, FLORIDA 33607-1462
TEL: 813.286.1711 FAX: 813.287.8591

SOLUTIA INC.
SAUGET AREA 1
CAHOKIA, ILLINOIS

EXISTING SITE PLAN

PROJECT NUMBER: C10000358.00
SHEET: G1.2

P. CARTWRIGHT 12/01/99 09:09

Notes:

1. Perimeter Containment Berms shall be constructed with compacted materials consisting of the following classification per ASTM D2487: SC, SP–SM, SC–SM, CL or CH.

2. Soils shall be compacted to 95% of Maximum Standard Proctor dry density at moisture contents of 2% below optimum moisture to 3% above optimum moisture.

P: CARTWRIGHT
R:\SOLUTIA\SAUGET\SITEPREP.DWG 12/01/99 09:14

REV	DESCRIPTION OF REVISION	BY	DATE

DESIGNED BY: M. BRUNGARD
DRAWN BY: P. CARTWRIGHT
CHECKED BY: G. WANTLAND
PROJECT MANAGER: G. WANTLAND
DATE: DECEMBER 3, 1999

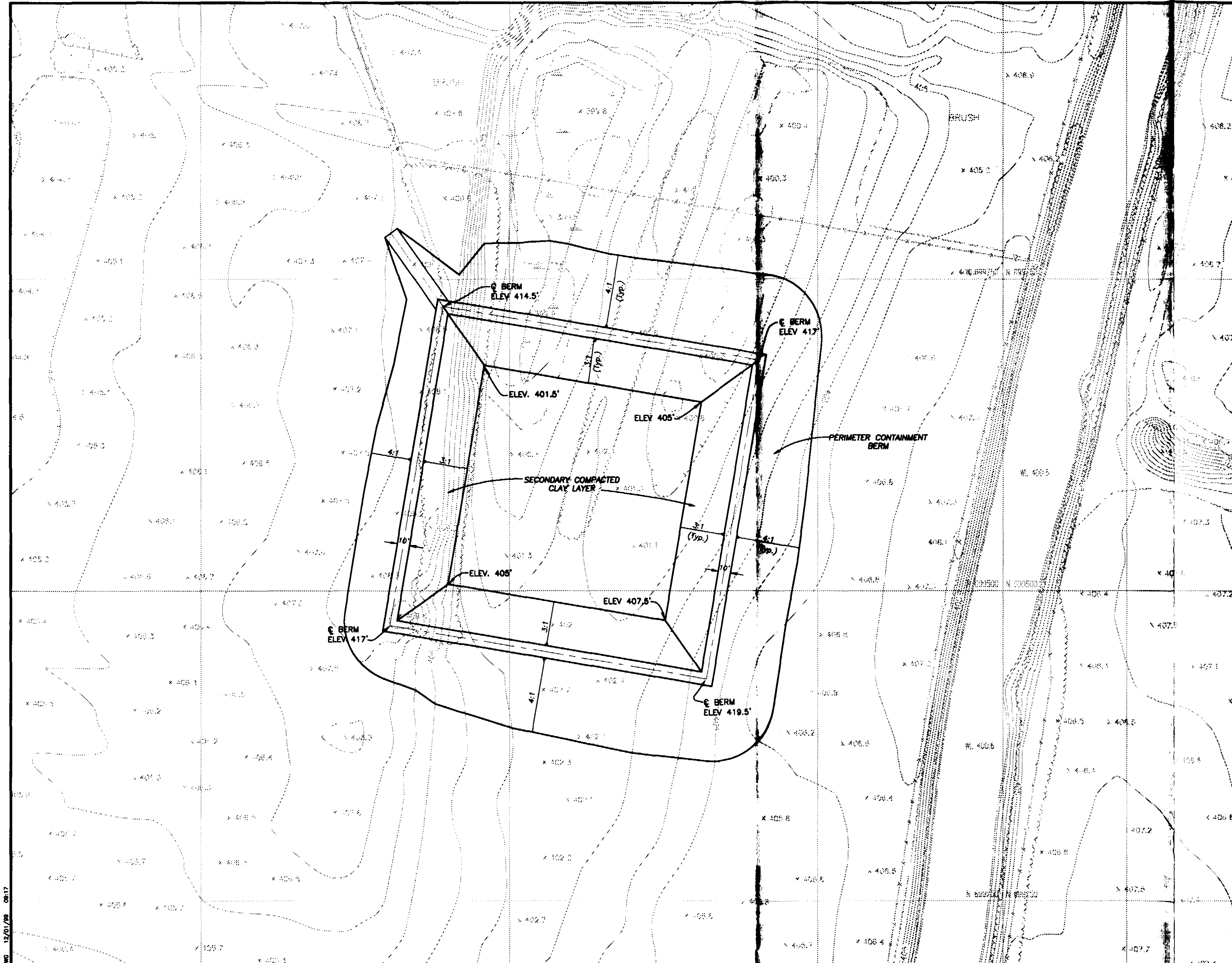
URS Greiner Woodward Clyde
7650 WEST COURTNEY CAMPBELL CSWY.
TAMPA, FLORIDA 33607–1462
TEL: 813.286.1711 FAX: 813.287.8591

SOLUTIA INC.
SAUGET AREA 1
CAHOKIA, ILLINOIS

SITE PREPARATION PLAN

PROJECT NUMBER
C100003899.00

SHEET
C1.1



N

40 0 40 80

SCALE: 1"=40'

Notes:

1. Secondary compacted clay layer shall be constructed of materials consisting of the following classifications per ASTM D 2487: CL or CH meeting the following requirements:

   Liquid Limit ≥ 30
   Plasticity Index ≥ 15
   Hydraulic Conductivity ≤ 1×10^{-7} cm/sec.

REV	DESCRIPTION OF REVISION	BY	DATE

DESIGNED BY: M. BRUNGARD
DRAWN BY: P. CARTWRIGHT
CHECKED BY: G. WANTLAND
PROJECT MANAGER: G. WANTLAND
DATE: DECEMBER 3, 1999

URS Greiner Woodward Clyde
7650 WEST COURTNEY CAMPBELL CSWY.
TAMPA, FLORIDA 33607-1462
TEL: 813.286.1711 FAX: 813.287.8591

SOLUTIA INC.
SAUGET AREA 1
CAHOKIA, ILLINOIS

SECONDARY COMPACTED CLAY LAYER

PROJECT NUMBER C100003899.00

SHEET **C1.2**

P. CARTWRIGHT R:\SOLUTIA\SAUGET_TOPCLAY.DWG 12/01/99 08:17

REV	DESCRIPTION OF REVISION	BY	DATE

DESIGNED BY: M. BRUNGARD
DRAWN BY: P. CARTWRIGHT
CHECKED BY: G. WANTLAND
PROJECT MANAGER: G. WANTLAND
DATE: DECEMBER 3, 1998

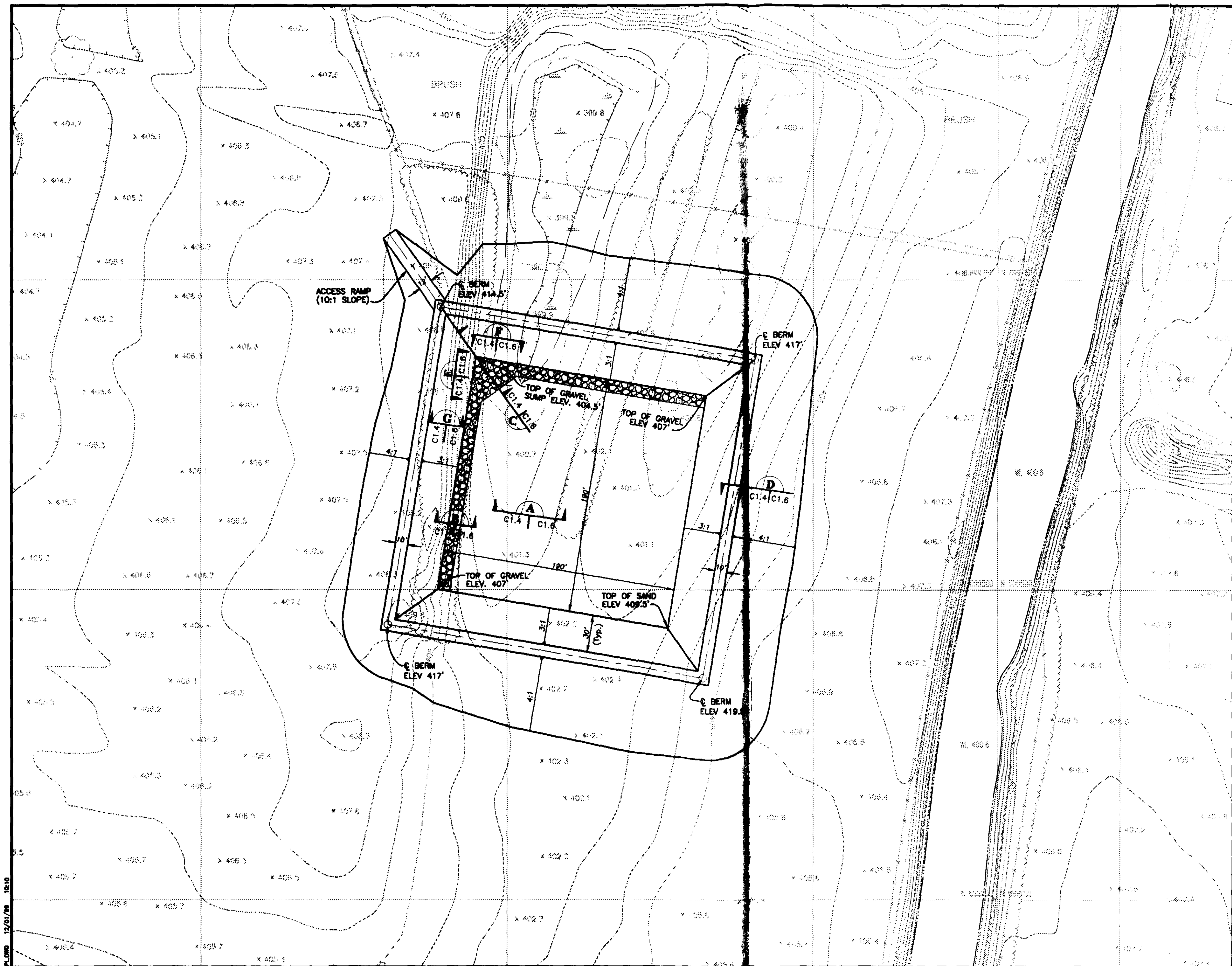
URS Greiner Woodward Clyde
7650 WEST COURTNEY CAMPBELL CSWY.
TAMPA, FLORIDA 33607-1462
TEL: 813.286.1711 FAX: 813.287.8591

SOLUTIA INC.
SAUGET AREA 1
CAHOKIA, ILLINOIS

PRIMARY GEOMEMBRANE LAYOUT

PROJECT NUMBER
C100003899.00

SHEET
C1.3



40 0 40 80

SCALE: 1"=40'

Notes:

1. *Access Ramp shall be extended down the inside slope of the landfill to facilitate dried sediment placement.*
2. *Inside ramp slope shall be no steeper than 6'(H.) : 1'(V.).*
3. *Inside ramp not shown for clarity.*

REV	DESCRIPTION OF REVISION	BY	DATE

DESIGNED BY: M. BRUNGARD
DRAWN BY: P. CARTWRIGHT
CHECKED BY: G. WANTLAND
PROJECT MANAGER: G. WANTLAND
DATE: DECEMBER 3, 1999

URS Greiner Woodward Clyde
7650 WEST COURTNEY CAMPBELL CSWY.
TAMPA, FLORIDA 33607-1462
TEL: 813.286.1711 FAX: 813.287.8591

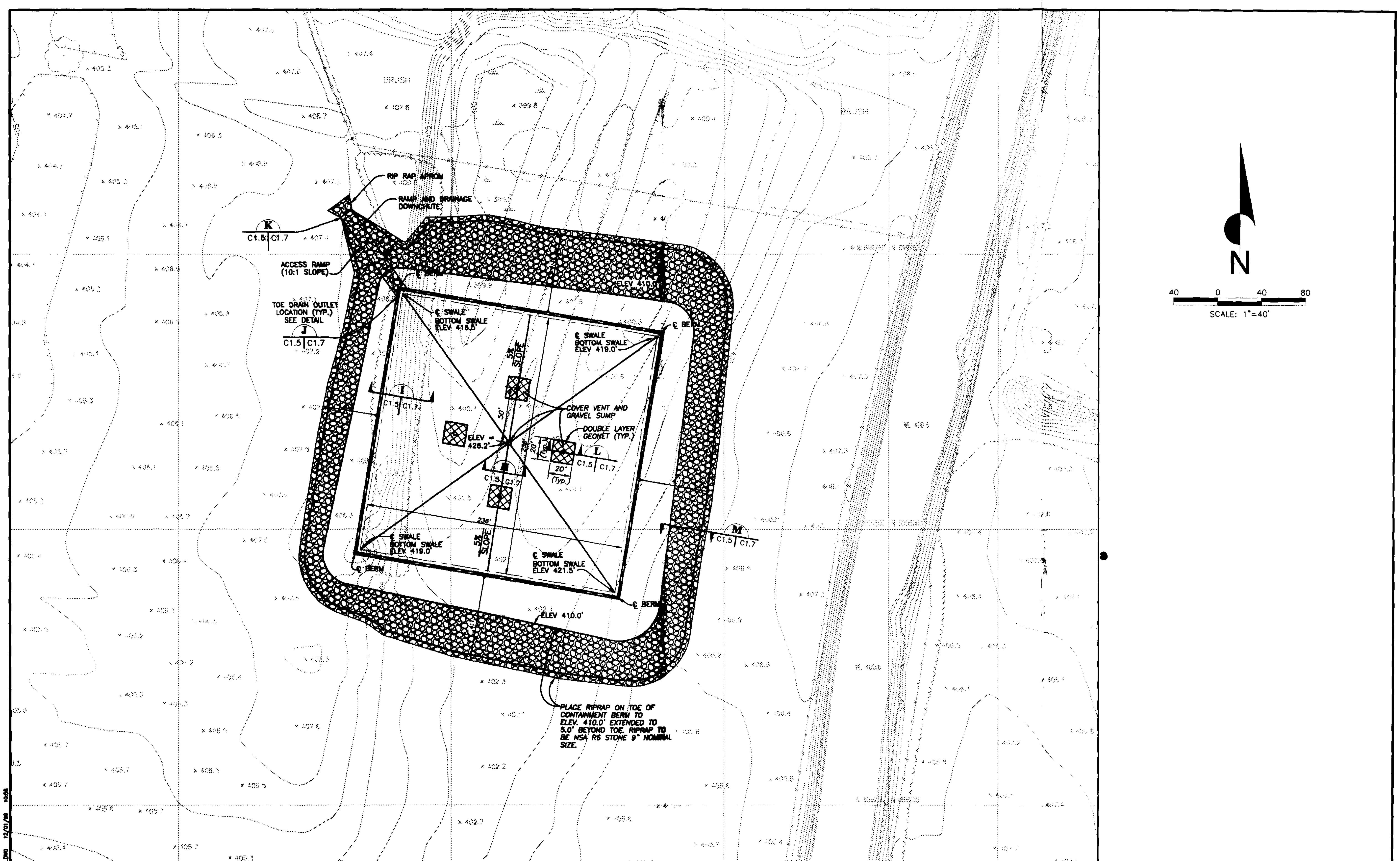
SOLUTIA INC.
SAUGET AREA 1
CAHOKIA, ILLINOIS

TOP OF PRIMARY COLLECTION SYSTEM PLAN

PROJECT NUMBER C100003899.00

SHEET **C1.4**

P. CARTWRIGHT 12/01/99 10:10



REV	DESCRIPTION OF REVISION	BY	DATE

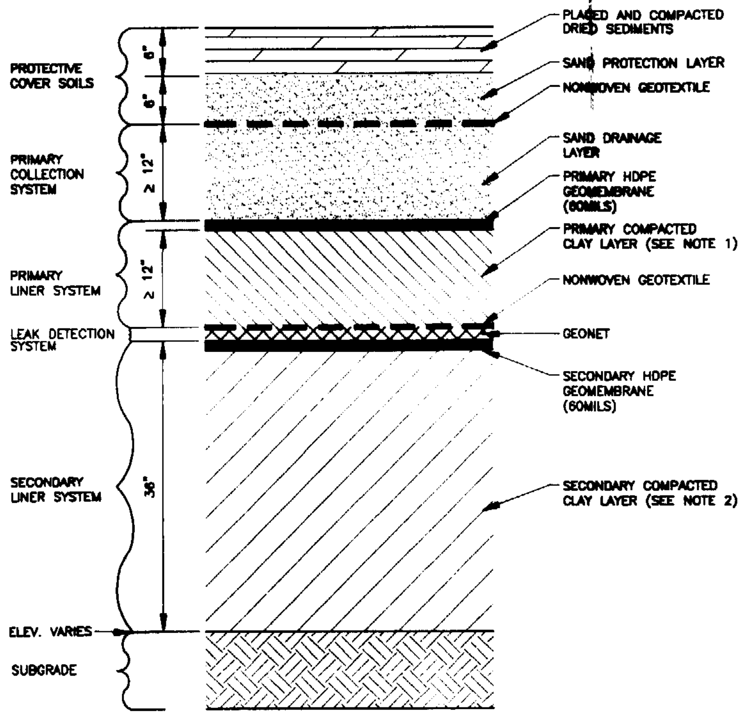
DESIGNED BY: M. BRUNGARD
DRAWN BY: P. CARTWRIGHT
CHECKED BY: G. WANTLAND
PROJECT MANAGER: G. WANTLAND
DATE: DECEMBER 3, 1999

URS Greiner Woodward Clyde
7650 WEST COURTNEY CAMPBELL CSWY.
TAMPA, FLORIDA 33607-1462
TEL: 813.286.1711 FAX: 813.287.8591

SOLUTIA INC.
SAUGET AREA 1
CAHOKIA, ILLINOIS

COVER SYSTEM PLAN

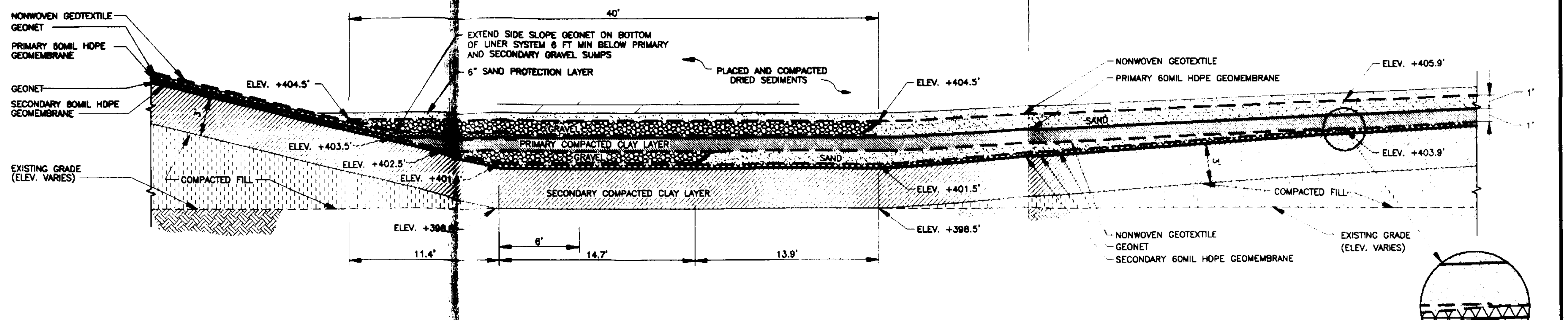
PROJECT NUMBER: C100003899.00
SHEET: C1.5



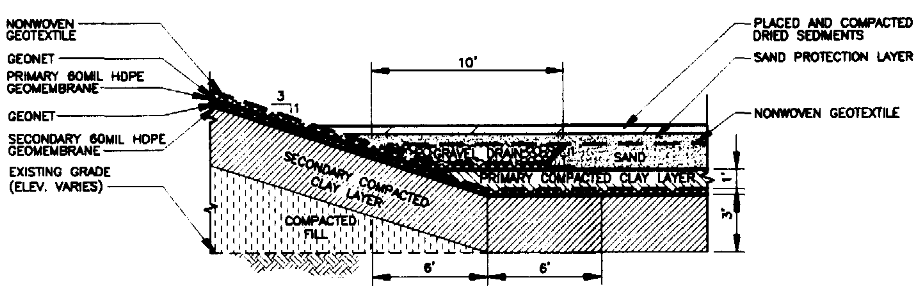
NOTES:

1. PRIMARY COMPACTED CLAY LAYER MAY BE CONSTRUCTED OF EITHER COMPACTED SOILS MEETING THE FOLLOWING CLASSIFICATION AS PER ASTM D2487 SC, SC-SM, SM-SP, CL, CH OR WITH A GEOSYNTHETIC CLAY LINER.
2. SECONDARY COMPACTED CLAY LAYER SHOULD MEET THE FOLLOWING REQUIREMENTS:
   $LL \geq 30$
   $PI \geq 15$
   $K \leq 1X10^{-7}$ CM/SEC

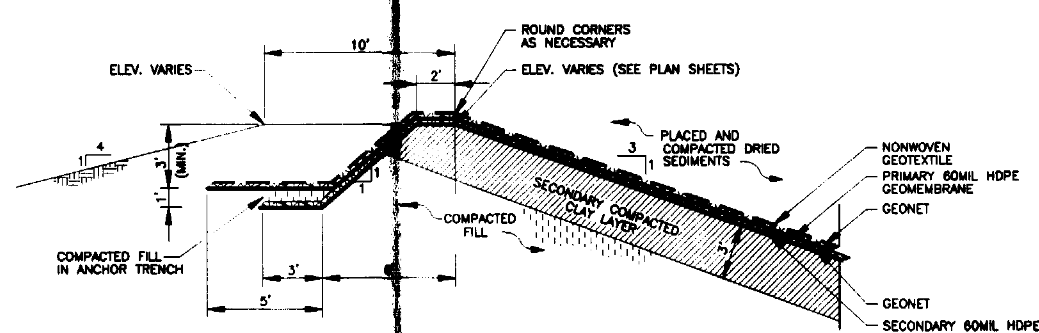
A BOTTOM LINER SYSTEM DETAIL
C1.4 | C1.6 N.T.S.



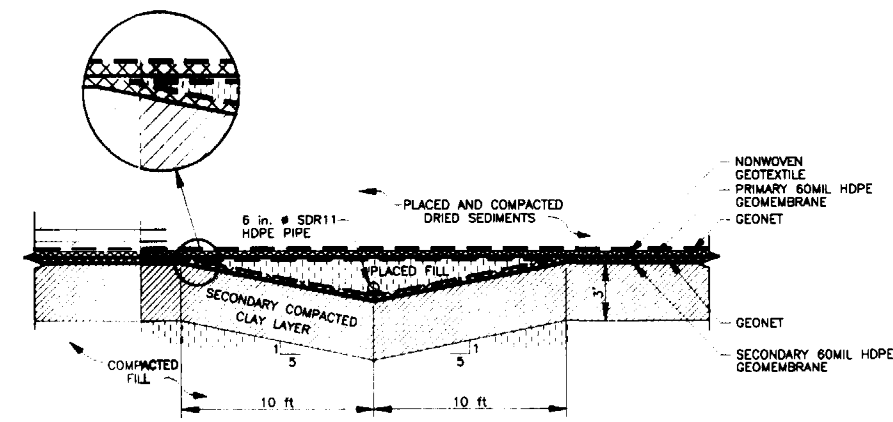
C COLLECTION SUMP DETAIL
C1.4 | C1.6 APPROX. SCALE: 1"= 5'



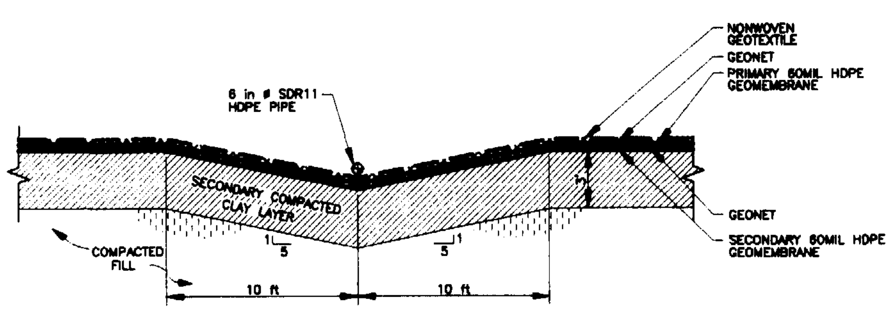
B GRAVEL DRAIN DETAIL
C1.4 | C1.6 APPROX. SCALE: 1" = 5'



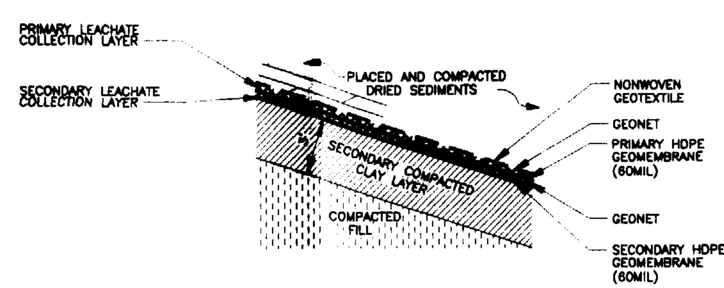
D PRIMARY LINER SYSTEM ANCHOR DETAIL
C1.4 | C1.6 APPROX. SCALE: 1" = 5'



E SECONDARY LEACHATE COLLECTION SYSTEM RISER PIPE DETAIL
C1.4 | C1.6 APPROX. SCALE: 1" = 5'



F PRIMARY LEACHATE COLLECTION SYSTEM SIDE SLOPE RISER PIPE DETAIL
C1.4 | C1.6 APPROX. SCALE: 1" = 5'



G SIDE SLOPE LINER SYSTEM DETAIL
C1.7 | C1.6 N.T.S

NOTE:
THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION BY SCALING. SOME ELEMENTS HAVE BEEN EXAGGERATED FOR CLARITY OF LOCATION.

REV	DESCRIPTION OF REVISION	BY	DATE

DESIGNED BY: G. WANTLAND
DRAWN BY: B. DOUGLAS
CHECKED BY: P. CARTWRIGHT
PROJECT MANAGER: G. WANTLAND
DATE: DECEMBER 3, 1999

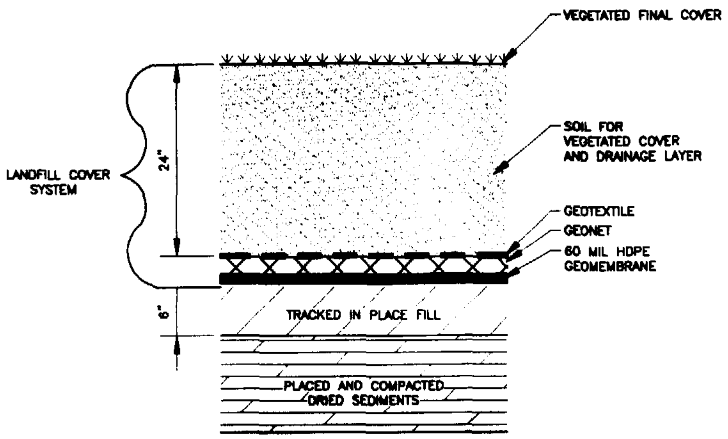
URS Greiner Woodward Clyde
7650 WEST COURTNEY CAMPBELL CSWY.
TAMPA, FLORIDA 33607-1462
TEL: 813.286.1711 FAX: 813.287.8591

SOLUTIA INC.
SAUGET AREA 1
CAHOKIA, ILLINOIS

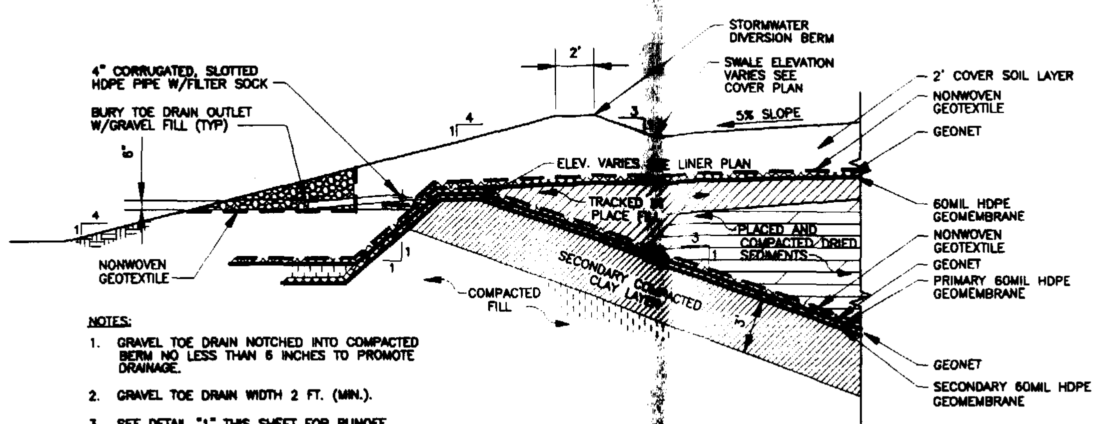
LINER SYSTEM DETAILS

PROJECT NUMBER C100003899.00
SHEET C1.6

B. DOUGLAS 11/30/99 13:54

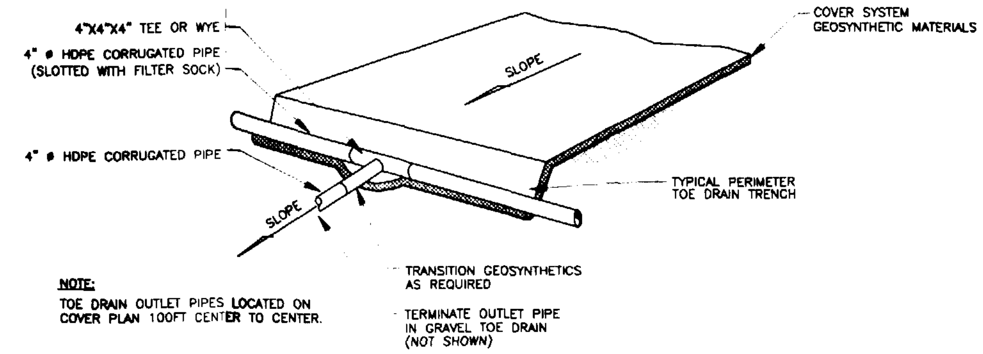


H COVER SYSTEM DETAIL
C1.5 | C1.7 N.T.S.



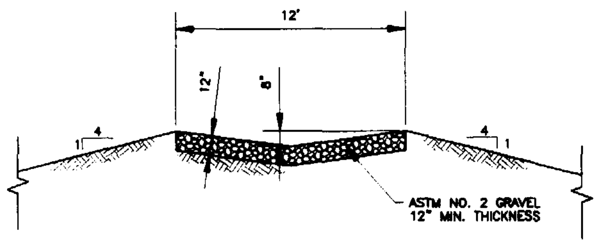
NOTES:
1. GRAVEL TOE DRAIN NOTCHED INTO COMPACTED BERM NO LESS THAN 6 INCHES TO PROMOTE DRAINAGE.
2. GRAVEL TOE DRAIN WIDTH 2 FT. (MIN.).
3. SEE DETAIL "1" THIS SHEET FOR RUNOFF CONTROL DURING PLACEMENT OF DRIED SEDIMENTS.

I COVER SYSTEM DETAIL
C1.5 | C1.7 N.T.S.

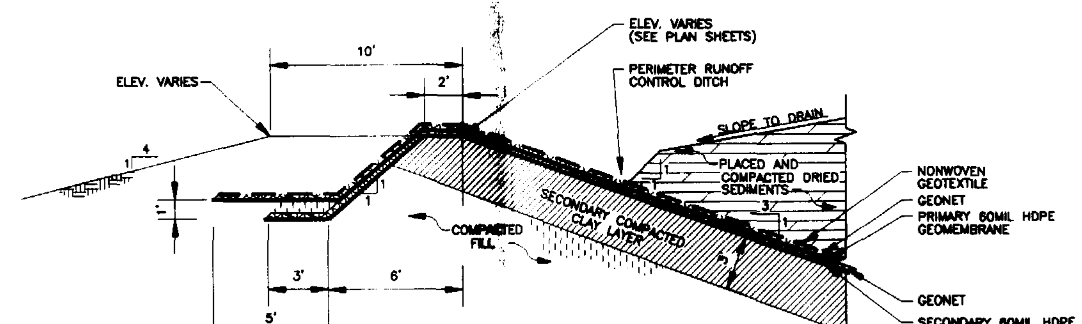


NOTE:
TOE DRAIN OUTLET PIPES LOCATED ON COVER PLAN 100FT CENTER TO CENTER.

TYPICAL
J TOE DRAIN OUTLET DETAIL
C1.5 | C1.7 N.T.S.

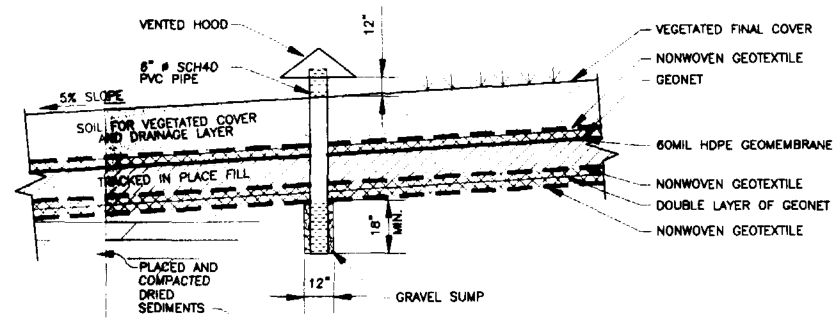


RAMP AND DOWNCHUTE SECTION
N.T.S.



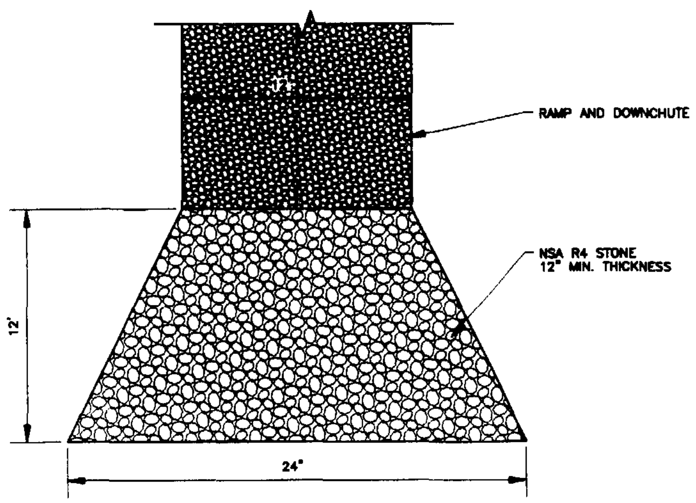
NOTES:
1. PLACE DRIED SEDIMENTS TO PROMOTE RUNOFF TO INSIDE DITCH AS SHOWN.

1 RUNOFF CONTROL BERM DETAIL
C1.7 | C1.7 APPROX. SCALE: 1" = 5'



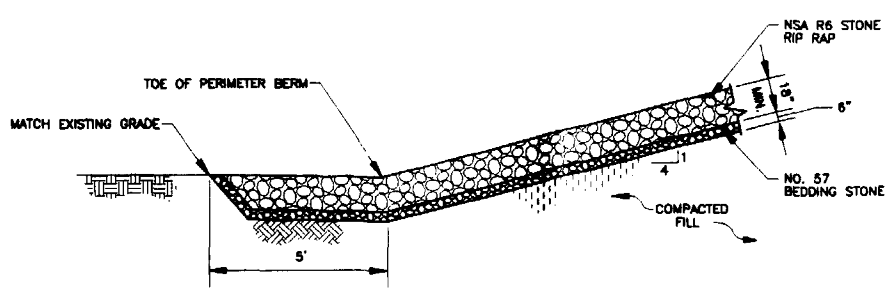
NOTES:
1. BOTTOM 24 INCHES AND TOP 12 INCHES OF PVC PIPE SHALL BE SLOTTED.
2. DOUBLE LAYER OF GEONET FOR VENT SHALL BE 20FT X 20FT IN PLAN.

L TYPICAL COVER VENT
C1.5 | C1.7 N.T.S.



RIP RAP APRON
N.T.S.

K DOWNLET DETAIL
C1.5 | C1.7 N.T.S.



M SLOPE ARMORING DETAIL
C1.5 | C1.7 N.T.S.

NOTE:
THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION BY SCALING. SOME ELEMENTS HAVE BEEN EXAGGERATED FOR CLARITY.

REV	DESCRIPTION OF REVISION	BY	DATE

DESIGNED BY: G. WANTLAND
DRAWN BY: B. DOUGLAS
CHECKED BY: P. CARTWRIGHT
PROJECT MANAGER: G. WANTLAND
DATE: DECEMBER 3, 1999

URS Greiner Woodward Clyde
7650 WEST COURTNEY CAMPBELL CSWY.
TAMPA, FLORIDA 33607-1462
TEL: 813.286.1711 FAX: 813.287.8591

SOLUTIA INC.
SAUGET AREA 1
CAHOKIA, ILLINOIS

COVER SYSTEM DETAILS

PROJECT NUMBER C100003899.00
SHEET C1.7

B. DOUGLAS R:\SOLUTIA\SAUGET\COSYDET.DWG 12/01/99 10:39

Appendix B

Site Geotechnical Investigation

URS Greiner Woodward Clyde
A Division of URS Corporation

2318 Millpark Drive
Maryland Heights, MO 63043
Tel: 314.429.0100
Fax: 314.429.0462
Offices Worldwide

December 2, 1999
23.99STL022.01

Mr. Bruce Yare
Manager, Remediation Technology
Solutia, Inc.
P.O. Box 66760
St. Louis, Missouri 63166

Subject: Report of Geotechnical Investigation
For Proposed Landfill Cell
Cahokia, Illinois

Dear Bruce:

This letter report transmits our geotechnical findings and recommendations for the subject site. The work was performed in accordance with our proposal dated October 28, 1999 and your authorization. The intent of this investigation was to obtain information to characterize the subsurface conditions and assess the foundation requirements for a landfill that would contain PCB-impacted materials (soil/sediment).

PROJECT DESCRIPTION

We understand that the landfill will be located on the Solutia property formerly known as the Moto property. It is planned that the northern boundary of the cell will be adjacent to the southern boundary of Site G (Figure 1) and the eastern boundary of the cell adjacent to the west bank of Dead Creek. We understand the planned cell area is on the order of about 1.4 acres. Based on Drawing C1.5 provided by, and conversations with the designer, the height of the perimeter berms will not likely exceed 20 ft above current existing grade, and the height at the center of the landfill, when capped, will be about 25 ft above the existing grade. The exterior slopes of the containment berms will be about 4:1 and the interior slopes about 3:1.

FIELD INVESTIGATION

A total of four borings were drilled and a piezometer installed on the property between November 8, 1999 through November 10, 1999. Two hand-augers borings were drilled on November 15,1999. The approximate locations of the borings and the piezometer installed for this study are shown in Figure 1 and also in Figure C1.5. The geotechnical borings are designated GB-1 through GB-3, the piezometer is PZ-1, and the hand-auger borings are HA-1 and HA-2. Two borings, GB-1 and GB-3, were drilled to depths of about 50 ft and GB-2 was drilled to a depth of about 75 ft. Boring GB-2 was drilled deeper to estimate the vertical extent of loose to medium dense alluvium to help assess settlement and liquefaction potential of the site. The piezometer boring was drilled to a depth of about 20 ft and a piezometer was installed to that depth. Currently the piezometer readings are made on a weekly basis. A URS Greiner Woodward Clyde (URSGWC) representative directed the field investigation, logged the borings and collected soil samples for laboratory testing. Potential borrow sources of fill material for berms have not yet been identified and evaluated.

The work was conducted in accordance with Solutia's site policies and procedures and with a site-specific health and safety plan approved by URSGWC and Solutia.

The borings were drilled with a CME-55 truck-mounted drilling rig owned and operated by Roberts Environmental Drilling, Inc. (REDI) of Illinois. Borings were advanced using 4-¼ inch I.D. hollow-stem augers. Once the water table was encountered, typically at a depth of between 9 to 14 ft below ground surface, borings were continued using a 3-7/8 inch diameter roller bit and a bentonite-based drilling mud.

Soil samples were obtained from the borings using either a 1-½ inch I.D. split-spoon sampler in accordance with the Standard Penetration Test (SPT) Method (ASTM D-1586) or a hydraulically pushed thin-walled sampler (Shelby tube) to obtain "undisturbed" samples.

Sampling was made at 2½-ft vertical intervals in the upper 10 ft and at 5-ft vertical intervals thereafter. Upon completion, the borings were tremmie-grounted with a cement-bentonite mixture. Drilling spoils and excess sample were placed in containers provided by Solutia along with drilling fluids displaced during grouting.

Field boring logs were prepared by a URSGWC representative based upon recovered soil samples, cuttings, drilling characteristics, and field conditions. The logs have been subsequently modified to reflect laboratory test results. Detailed logs of borings and piezometer installation are attached. Graphic boring logs depicting generalized subsurface conditions are shown in Figure 2.

LABORATORY TESTING

Laboratory tests were performed on selected soil samples to characterize the index and strength properties of the subsurface soils. The tests performed included visual classification, water contents, liquid and plastic limits, unconfined compression strength and a consolidation test. Results of the laboratory tests are summarized in Table 1 and are also included on the detailed boring logs. Unconfined compression tests and consolidation test figures are also attached.

SUBSURFACE CONDITIONS

The subsurface conditions at this property primarily consist of about 5 ft of low plasticity silty clayey soil in Borings GB-1 through GB-3 to about 20 ft of clayey silts in PZ-1. The upper 5 ft of clayey materials is underlain by alluvial non-plastic fine sandy silts to depths of about 20 ft in Borings GB-1 and GB-3. Alluvial sands underlie the sandy silts to the drilled depths. The consistency of the upper cohesive material is typically firm to stiff. The silts within the upper 20 ft are typically loose and the alluvial sands immediately below the sandy silts are loose to medium dense, and become medium dense to dense with depth. In Borings GB-1 and GB-2, the relative density indicates a loose to medium dense layer exists between elevation 370 and 360 (depth between 40 and 50 ft). Below elevation 360 the relative density varies between medium dense to very dense.

GROUNDWATER

The water surface was encountered between 9 and 15 ft in all borings at the time of drilling on November 8, 1999. Groundwater was observed at a depth of about 9.5 ft below grade in the piezometer boring. A piezometric reading of 9.77 ft was recorded on November 15, 1999 and 9.95 ft on November 22, 1995. A piezometer reading of 10.22 ft was recorded on 12/1/1999. Weekly readings of the piezometer are planned. There have been only small changes in the piezometer readings to date.

ENGINEERING ANALYSIS AND RECOMMENDATIONS

Based upon the results of our field investigation, laboratory test results, engineering analyses, and experience, the following conclusions and recommendations are provided.

The alluvium encountered within 5 to 10 ft below the water table is generally loose to medium dense. The liquefaction potential of the site was evaluated using the "simplified procedure" by Seed and Idriss, (1972) as updated in NCEER, 1997, and Idriss, 1998. The ground motion parameters were estimated using a peak ground acceleration (PGA) of 0.1g obtained from the USGS Hazard Maps for the area by Zip Code. An earthquake magnitude (Mw) 6.5 was selected based on our previous studies in this general area. Based on this analysis, liquefaction is not triggered at the site. Liquefaction induced settlement due to shaking of up to 3 inches was calculated for the site. The consequences of damage to the liner and the foundation are judged to be insignificant and tolerable.

Based on our understanding, the exterior slopes will be constructed with a slope of 4:1 and the interior will be 3:1, therefore the risk of slope instability is negligible. Assuming no water outside the slope and that the berm will be constructed of well compacted cohesive material with a cohesion of about 1000 psf and weighing about 120 pcf, and allowing for a surcharge of about 200 psf we estimated that the minimum factor of safety against slope stability to be about 3.75. The slopes are judged to be stable under seismic conditions. For the proposed geometry, topographic conditions and subsurface conditions, risk of damage due to lateral spreading or landsliding during seismic activity is judged to be negligible.

The anticipated differential settlements of the liner between the center of the cell and the center of the berm due to the weight of the berm and landfilled materials using Schmertmann (1978) are less than 1/4 inch. These estimates pertain to settlement of the 5-ft thick proposed liner system. The total anticipated settlement is the sum of the static settlement provided above and the 3 inches obtained from the liquefaction analysis. Please note that in the case of liquefaction induced settlements the total can also be equal to the differential settlement. However the magnitude of the sum of these is judged to be tolerable for the landfill liner and foundation system assuming the landfill material in the cell are silts and sands placed under controlled conditions and compacted to minimize further settlement during a seismic event.

Based on the consolidation test results, most of the static foundation settlement will probably occur during construction. Therefore, long-term settlement of the foundation soils and the liner are judged to be insignificant to the integrity of the landfill and foundation soils.

We are pleased to provide you with these services and look forward to our continued involvement in this project.

Sincerely,

George M. S. Manyando, Ph.D., P.E.
Senior Geotechnical Engineer

William L Durbin, P.E.
Senior Principal

GMM/RBB/WLD:efb

Attachments

W. L. DURBIN
REGISTERED PROFESSIONAL ENGINEER
ILLINOIS
12/2/99

Project No.: 23-99STL022.01 File: Indx1.xls

TABLE 1

SOLUTIA

LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	TOTAL UNIT WEIGHT (pcf)	STRENGTH Type Test	PEAK DEVIATOR STRESS (tsf)	AXIAL STRAIN @ PEAK STRESS (%)	CONSOL. INITIAL CONDITIONS VOID RATIO (-)	SATUR-ATION (%)	REMARKS
GB-1		1-2.5	13.5		np		SM								
GB-1		4.35-4.7	20.4				ML		106.3	UC	0.52	3.2			
GB-1		5.05-5.4	18.7				ML								
GB-1		5.4-5.75	18.3				ML								
GB-1		6-8							111.3						
GB-1		6.15	21.8												
GB-1		6.45	28.2				ML		115.0	UC	0.48	7.7			
GB-1		6.75	32.5												
GB-1		7.3	35.3												
GB-1		7.55	32.3		np		ML		113.9				1.000	89.0	
GB-1		9-10.5	32.6				CL-ML								
GB-1		14-15.5	36.6				SM	43.2							
GB-1		19-20.5	32.3				SP-SM	6.2							
GB-2		1-3							112.0						
GB-2		1.1	22.3												
GB-2		1.35	22.6				ML		116.0	UC	0.95	4.0			
GB-2		1.65	19.4												
GB-2		5.3-5.65	28.1	34	24	10	ML								
GB-2		6-7.5	29.5				CL-ML								
GB-2		9-10.5	25.5				SP-SM	9.1							
GB-2		29-30.5	22.1				SP	3.7							
GB-2		34-35.5	17.9				SP	3.6							
GB-2		49-50.5	21.2				SP	2.1							

Prepared by: CMJ Reviewed by: JJ Date: 11/30/1999

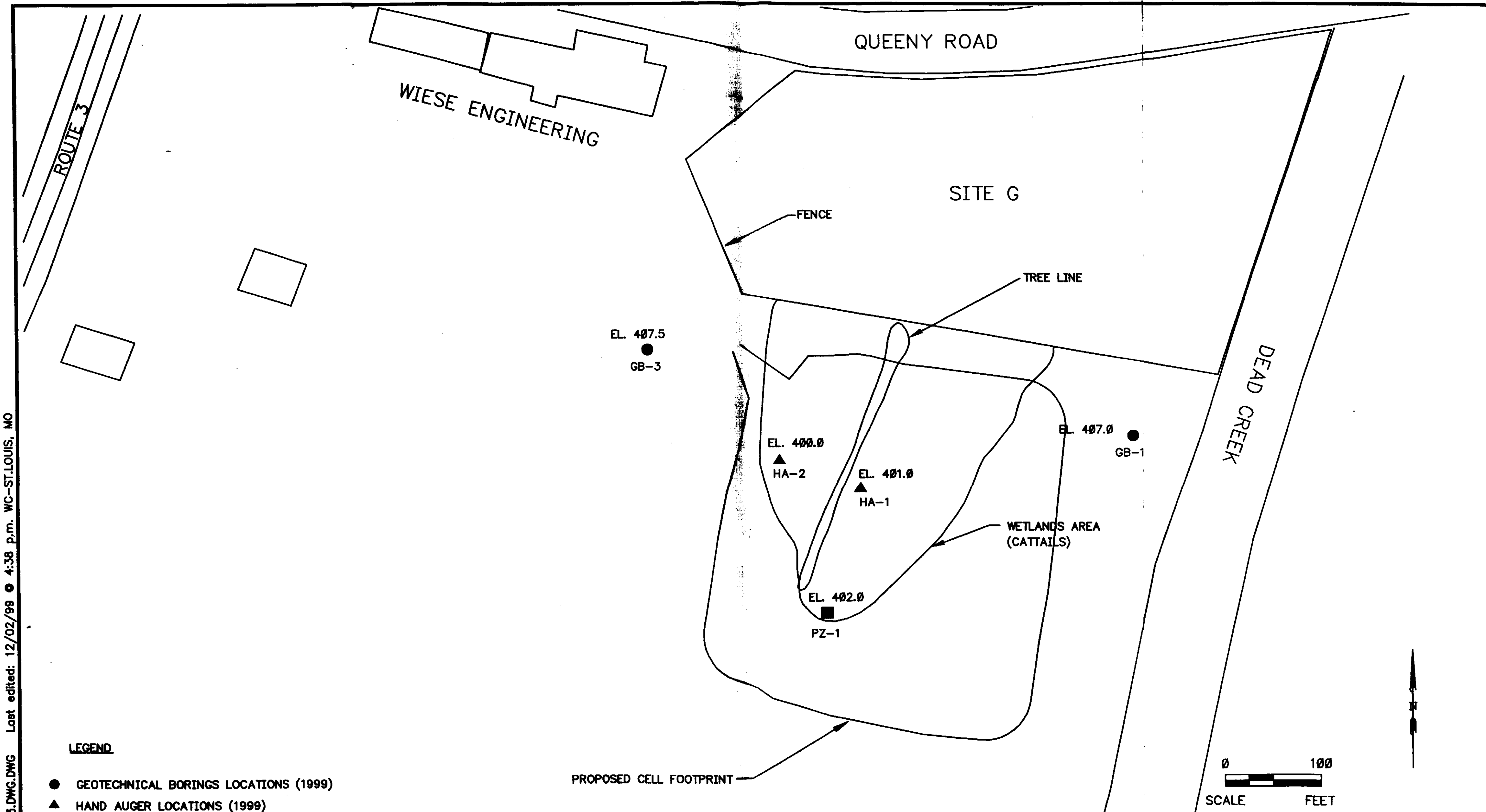
TABLE 1 CONTINUED

SOLUTIA
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS							STRENGTH			CONSOL.		REMARKS
			WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	TOTAL UNIT WEIGHT (pcf)	Type Test	PEAK DEVIATOR STRESS (tsf)	AXIAL STRAIN @ PEAK STRESS (%)	INITIAL CONDITIONS VOID RATIO (-)	INITIAL CONDITIONS SATUR-ATION (%)	
GB-3		1-3							91.7						
GB-3		1.15	13.5												
GB-3		1.7	6.4												
GB-3		2.25	8.9												
GB-3		7.1-7.45	7.1				SM	18.1							
GB-3		7.45-7.8	6.2				SP								
GB-3		7.8-8.15	21.2				SP								
GB-3		8.15-8.5	8.1				SP		88.9						
GB-3		9-10.5	34.5				SM	48.6							
GB-3		11.5-13	35.5	32	25	7	ML								
GB-3		14-15.5	32.8				CL-ML								
GB-3		19-20.5	26.9				SP	4.8							
GB-3		44-45.5	18.8				SP	2.1							
P2-1		1-2.5	31.2				CL								
P2-1		4-5.5	36.0	60	20	40	CH								
P2-1		6-7.5	36.4				CL-ML								

Note: (1) USCS symbol based on visual observation unless Sieve and Atterberg limits reported.

Prepared by: CMJ Reviewed by: SJ Date: 11/30/1999

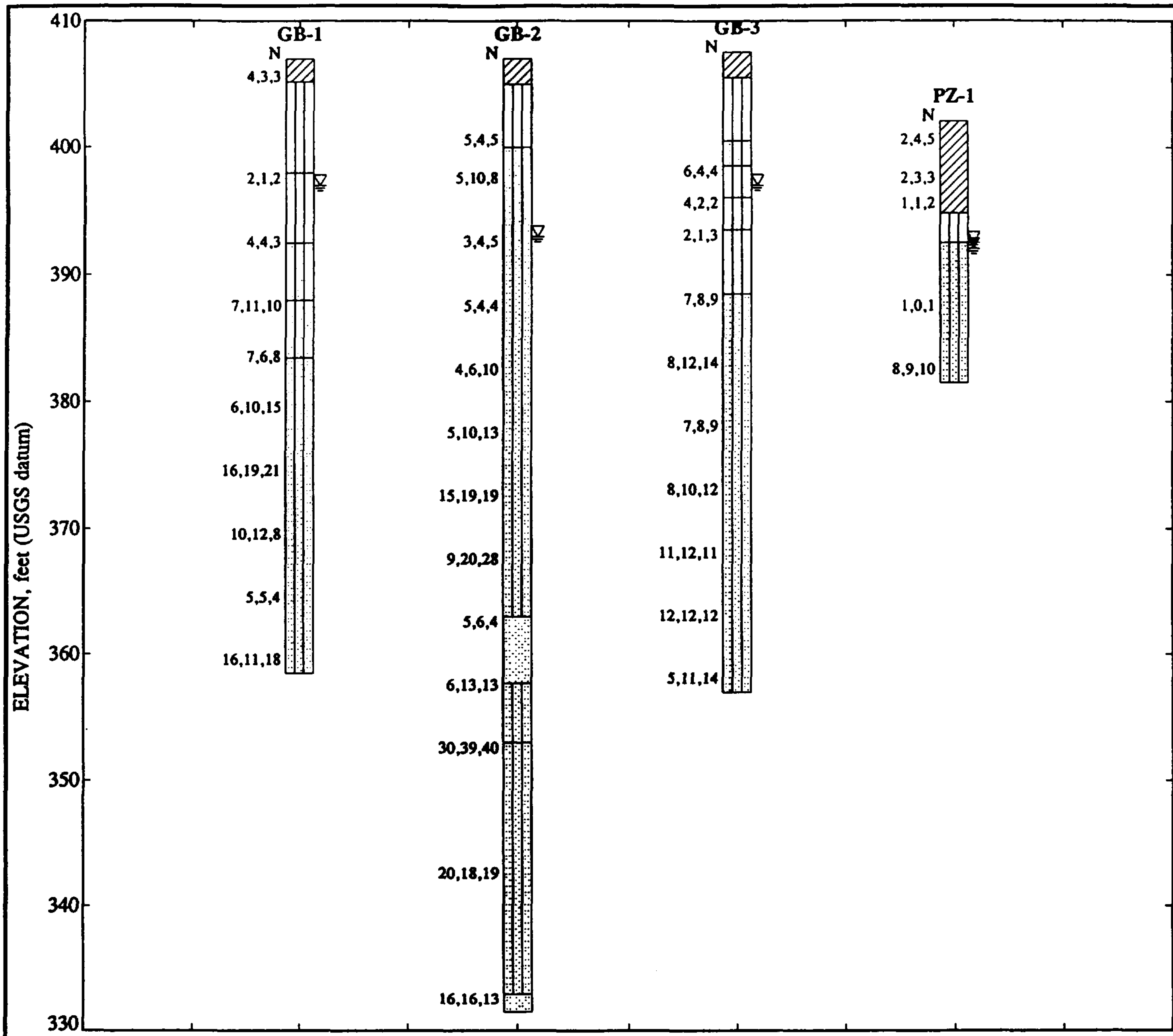


TSCA CELL INVESTIGATION SOLUTIA PROPERTY CAHOKIA, ILLINOIS	PROJECT NO. 2399STL022.00

URS Greiner Woodward Clyde
A Division of URS Corporation

DRN. BY: djd 11/11/99 DSGN. BY: th CHKD. BY:	Boring Plan Location	FIG. NO. 1

File: F:\99STL022\FIG3.DWG.DWG Last edited: 12/02/99 @ 4:38 p.m. WC-ST.LOUIS, MO



Legend:

- Low plastic CLAY
- Low plastic SILT
- Silty SAND
- SAND

- Water level entry at time of drilling
- Water level after drilling
- P: Hydraulically pushed sample
- RQD: Rock Quality Designation
- 7,10,15: Blows/6" penetration of sampler unless indicated otherwise
- N-values equal sum of blows for last 12 inches

NOTE: These graphic logs depict generalized soil conditions. Refer to individual logs for details.

Drawn by: djd	Checked by: gmm	Date: 11/17/99

Solutia, Sauget, Illinois

Project No. 2399STL022

Woodward-Clyde Consultants

Graphic Boring Logs

Figure 2.

LOG of BORING No. GB-1

DATE 11/8/99 SURFACE ELEVATION, FT 407.0 DATUM USGS LOCATION See Figure 1

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	FIELD Qu,KSF	NMC, %	LL	PI	Qu, KSF	NOTES
0				Firm, dark brown, moist, low plasticity Silty CLAY (CL)									Boring advanced with 4 1/4in. I.D HSA and Mud rotary
		4 3 3	100		405.2								
				Loose tan, dry, fine Sandy SILT (ML)	1.8				14				
			83										
5								0.5	20				
			83						19 18				
				Becoming moist				0.5	22 28 33 35				
					398.0				32				
		2 1 2	100	Very loose, tan, wet, SILT (ML); with trace of clay and some fine sand ⊽	9.0								
10									33				
				Becoming loose									
		4			392.5								
15		4 3		Loose, wet, tan, fine Silty SAND (SM)	14.5				37				Switch to Mud Rotary
					388.0								
20		7 11 10	83	Medium dense, tan, wet fine Sandy SILT, to Silty SAND (SM/ML)	19.0				32				
		7	72		383.5								
		6 8		Medium dense, tan, wet, medium to fine Silty SAND (SM)	23.5								

Completion Depth: 48.5 Ft. Water Depth: 10 ft., After ATD hrs.

Project No.: 2399STL022 ft., After hrs.

Project Name: Solutia ft., After hrs.

Drilling Contractor: Redi Logged by: Tim Hicks

12/2/99 WCCXS TL022

URS Greiner Woodward Clyde

LOG of BORING No. GB-1

DATE 11/8/99 SURFACE ELEVATION, FT 407.0 DATUM USGS LOCATION See Figure 1

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	FIELD Qu,KSF	NMC, %	LL	PI	Qu, KSF	NOTES
25												
	6 10 15	83	Becoming gray, medium dense, medium to fine gravel									
30			Medium dense, gray Silty SAND (SM); with trace of medium to fine gravel									
	16 19 21	83	Becoming dense and less silty									
35												
	10 12 8	67	Becoming medium dense									
40												
	5 5 4	67	Becoming loose									
45			Loose, wet, gray Silty SAND (SM)									
	16 11 18		Becoming medium dense	358.5								
			Bottom of boring at 48.5ft.	48.5								

Completion Depth: 48.5 Ft. Water Depth: 10 ft., After ATD hrs.
Project No.: 2399STL022 ft., After hrs.
Project Name: Solutia ft., After hrs.
Drilling Contractor: Redi Logged by: Tim Hicks

12/2/99 WCCXS TL022

URS Greiner Woodward Clyde

LOG of BORING No. GB-2

DATE 11/9/99 SURFACE ELEVATION, FT 407.0 DATUM USGS LOCATION See Figure 1

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	FIELD Qu,KSF	NMC, %	LL	PI	Qu, KSF	NOTES
0			33	Brown, soft, moist, low plasticity Silty CLAY (CL)	405.0			1.0	22 23				Boring advanced with 4 1/4in. I.D HSA and Mud Rotary
				Loose. tan, dry, fine Sandy SILT (ML)	2.0				19				
5			58	Becoming Medium dense, gray with iron staining									
		5 4 5	49		400.0				28	34	10		
				Loose, moist, gray, fine Silty SAND (SM)	7.0				30				
10		5 10 8	89	Becoming medium dense, light brown and gray					26				
15		3 4 5	67	Becoming loose and saturated ▽									Switched to Mud Rotary
20		5 4 4	78	Trace of fine gravel, becoming coarse to fine sand									
		4	67	Becoming medium dense with a trace of medium to fine gravel									

Completion Depth: 75.5 Ft. Water Depth: 14 ft., After ATD hrs.

Project No.: 2399STL022 ft., After hrs.

Project Name: Solutia ft., After hrs.

Drilling Contractor: Redi Logged by: Tim Hicks

URS Greiner Woodward Clyde

LOG of BORING No. GB-2

DATE 11/9/99 SURFACE ELEVATION, FT 407.0 DATUM USGS LOCATION See Figure 1

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	PP, TSF	FIELD Qu,KSF	NMC, %	LL	PI	Qu, KSF	NOTES
25	6 10		Medium dense, gray, wet Silty SAND (SM); with a trace medium to fine gravel								
30	5 10 13		Medium dense, gray, wet Silty SAND (SM)				22				
35	15 19 19	67	Becoming dense				18				
40	9 20 28	78	With fine gravel, decrease in silt content	363.0 44.0							
45	5 6 4	78	Loose, medium dense, moist, gray coarse to fine SAND (SP); with some fine gravel	357.7 49.3							
	6	78									

Completion Depth: 75.5 Ft. Water Depth: 14 ft., After ATD hrs.

Project No.: 2399STL022 ft., After hrs.

Project Name: Solutia ft., After hrs.

Drilling Contractor: Redi Logged by: Tim Hicks

URS Greiner Woodward Clyde

LOG of BORING No. GB-2

DATE 11/9/99 SURFACE ELEVATION, FT 407.0 DATUM USGS LOCATION See Figure 1

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	FIELD Qu,KSF	NMC, %	LL	PI	Qu, KSF	NOTES
50		13 13		Medium dense, gray, moist, medium to fine SAND (SM/SP); with trace of silt					21				
					353.0 54.0								
55		30 39 40	100	Very dense, gray, moist, fine Silty SAND (SM)									
60				Very dense, gray, moist fine Silty SAND (SM)									
65		20 18 19	83	Becoming dense with some silt, coarse to fine sand, trace of fine gravel									
70													
					333.0 74.0								
		16	83										

Completion Depth: 75.5 Ft.

Water Depth: 14 ft., After ATD hrs.

ft., After hrs.

ft., After hrs.

Project No.: 2399STL022

Project Name: Solutia

Drilling Contractor: Redi

Logged by: Tim Hicks

12/2/99 WCCXS TL022

URS Greiner Woodward Clyde

LOG of BORING No. GB-2

DATE 11/9/99 SURFACE ELEVATION, FT 407.0 DATUM USGS LOCATION See Figure 1

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	FIELD Qu,KSF	NMC, %	LL	PI	Qu, KSF	NOTES
75		16		Becoming medium dense, gray, wet, coarse to fine gravel with medium to fine SAND (SP)	331.5								
		13			75.5								
				Bottom of boring at 75.5ft.									
80													
85													
90													
95													

Completion Depth: 75.5 Ft. Water Depth: 14 ft., After ATD hrs.

Project No.: 2399STL022 ft., After hrs.

Project Name: Solutia ft., After hrs.

Drilling Contractor: Redi Logged by: Tim Hicks

URS Greiner Woodward Clyde

LOG of BORING No. GB-3

DATE 11/10/99 SURFACE ELEVATION, FT 407.5 DATUM USGS LOCATION See Figure 1

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	PP, TSF	FIELD Qu,KSF	NMC, %	LL	PI	Qu, KSF	NOTES
0		83	Medium stiff, dark brown, moist, low plasticity Silty CLAY (CL)	405.5			14 6 9				Boring advanced with 4 1/4in. I.D HSA and Mud Rotary
		63	Loose, tan, dry SILT (ML); with some sand and trace of clay	2.0							
5		83		400.5							
			Loose, tan, dry fine SAND (SM); with some silt	7.0 398.5			7 6 21 8				
	6 4 4	94	Loose, brown, moist, fine Sandy SILT (ML/SM) Becoming saturated	9.0 396.0			35				
10	4 2 2	83	Loose, gray, wet SILT (ML); with some sand	11.5 393.5			36	32	7		Switched to Mud Rotary
15	2 1 3	83	Loose, brown, tan, wet Sandy SILT (ML)	14.0 388.5			33				
20	7 8 9	83	Medium dense, tan, gray, fine Silty SAND (SM)	19.0			27				
	8	83									

Completion Depth: 50.5 Ft. Water Depth: 10.5 ft., After ATD hrs.

Project No.: 2399STL022 ft., After hrs.

Project Name: Solutia ft., After hrs.

Drilling Contractor: Redi Logged by: Tim Hicks

URS Greiner Woodward Clyde

LOG of BORING No. GB-3

DATE 11/10/99 SURFACE ELEVATION, FT 407.5 DATUM USGS LOCATION See Figure 1

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	FIELD Qu,KSF	NMC, %	LL	PI	Qu, KSF	NOTES
25		12 14		Medium dense, tan, gray fine SAND (SM)									
30		7 8 9	67										
35		8 10 12	83	Decrease in silt content, becoming trace of silt, and trace ofr medium to fine gravel									
40		11 12 11	72	Decrease in silt content, trace of silt and trace of medium to fine gravel									
45		12 12 12	67	Medium dense, tan, gray, fine SAND (SM)					19				
		5	72										

Completion Depth: 50.5 Ft. Water Depth: 10.5 ft., After ATD hrs.

Project No.: 2399STL022 ft., After hrs.

Project Name: Solutia ft., After hrs.

Drilling Contractor: Redi Logged by: Tim Hicks

URS Greiner Woodward Clyde

LOG of BORING No. GB-3

DATE 11/10/99 SURFACE ELEVATION, FT 407.5 DATUM USGS LOCATION See Figure 1

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	FIELD Qu,KSF	NMC, %	LL	PI	Qu, KSF	NOTES
50		11			357.0								
		14		Bottom of boring at 50.5ft.	50.5								
55													
60													
65													
70													

Completion Depth: 50.5 Ft. Water Depth: 10.5 ft., After ATD hrs.

Project No.: 2399STL022 ft., After hrs.

Project Name: Solutia ft., After hrs.

Drilling Contractor: Redi Logged by: Tim Hicks

URS Greiner Woodward Clyde

LOG of BORING No. PZ-1

Sheet 1 of 1

DATE 11/8/99 SURFACE ELEVATION, FT 402.0 DATUM USGS LOCATION See Figure 1

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	FIELD Qu,KSF	NMC, %	LL	PI	Qu, KSF	NOTES
0				Soft, moist, brown,low plasticity Silty CLAY									Boring advanced with 4 1/4in. I.D HSA
		2 4 5	100	Becoming stiff					31				
5		2 3 3	100	Becoming firm, medium plasticity mottled brown, gray			1.5		36	60	40		
		1 1 2	100		394.8								
				Very loose, wet, gray, Sandy SILT (ML); with medium to fine sand	7.2				36				
					392.5								
10				Loose, wet, gray, medium to fine SAND (SM); with some silt	9.5								
15		1 0 1	78	Very loose, wet, tan, fine SAND (SM); with a trace of silt									
20		8 9 10	88	Becoming medium dense	381.5								
				Bottom of boring at 20.5ft.	20.5								

Completion Depth: 20.5 Ft. Water Depth: 9.5 ft., After ATD hrs.

Project No.: 2399STL022 10 ft., After 18 hrs.

Project Name: Solutia ft., After hrs.

Drilling Contractor: Redi Logged by: Tim Hicks

URS Greiner Woodward Clyde

MONITORING WELL INSTALLATION REPORT

Well No. PZ-1

Project Solutia

Location See Figure 1.

Project No 2399STL022 Installed By Redi

Date 11/8/99 Time 1100

Method of Installation 4 1/4in. H.S.A. Done 1150

LOG OF BORING AND WELL

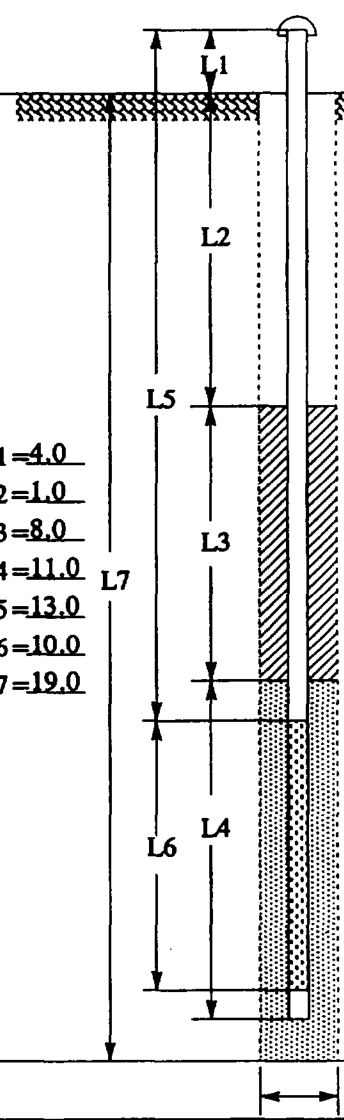
BORING

Depth in Ft.	Description	Symbol
0.00	Soft, moist, brown, low plasticity Silty CLAY Becoming stiff Becoming firm, medium plasticity mottled brown, gray	
7.20	Very loose, wet, gray, Sandy SILT (ML); with medium to fine sand	
9.50	Loose, wet, gray, medium to fine SAND (SM); with some silt Very loose, wet, tan, fine SAND (SM); with a trace of silt Becoming medium dense	
	Bottom of boring at 20.5ft.	

WELL

Type of Well

Ground Elev. Top of Riser Elev.



L1 = 4.0
L2 = 1.0
L3 = 8.0
L4 = 11.0
L5 = 13.0
L6 = 10.0
L7 = 19.0

Riser Pipe I.D., in. 1in.

Type of Pipe PVC

Backfill Type Around Riser Portland cement

Top of Seal Elevation

Type of Seal Material See below

Top of Filter Elevation 8.0

Type of Filter Material Quartz

Size of Opening, in. 0.01

Diameter of Well Tip, in. 1.0

Bottom of Screen Elevation 19.0

Bottom of Riser Elevation 19.0

Bttm of Boring Elev. 19.0

Diameter of Boring, in. 4.2

Remarks

Inspected By Tim Hicks

WOODWARD-CLYDE CONSULTANTS

LOG of BORING No. HA-1

DATE 11/15/99 SURFACE ELEVATION, FT 401.0 DATUM USGS LOCATION See Figure 1.

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	FIELD Qu,KSF	NMC, %	LL	PI	Qu, KSF	NOTES
0				Firm, dark brown, low to medium Silty CLAY (CL)	399.5 / 1.5								
				Loose, tan, fine Sandy SILT (SM); with trace of clay	399.0 / 2.0								
				Bottom of Hand Auger at 2ft.									
5													

Completion Depth: 2.0 Ft.
Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.
Project No.: 2399STL022
Project Name: Solutia
Drilling Contractor: Redi
Logged by: Tim Hicks

11/19/99 WCCXS TL022

URS Greiner Woodward Clyde

LOG of BORING No. HA-2

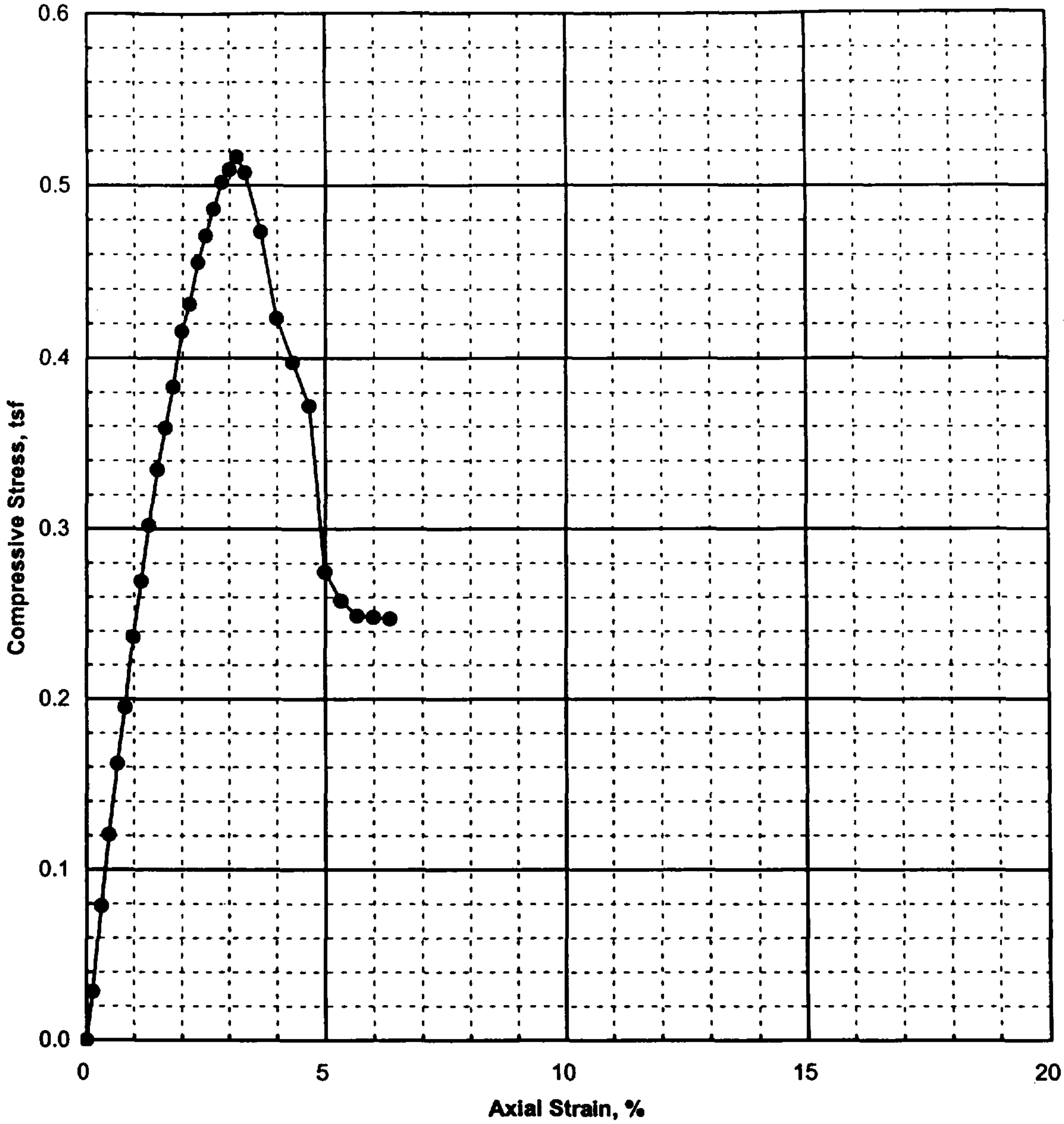
DATE 11/15/99 SURFACE ELEVATION, FT 400.0 DATUM USGS LOCATION See Figure 1.

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	FIELD Qu,KSF	NMC, %	LL	PI	Qu, KSF	NOTES
0				Firm, dark brown, low to medium plasticity Silty CLAY (CL)	398.5 1.5								
				Loose, tan, fine Sandy SILT (SM); with trace of clay	398.0 2.0								
				Bottom of Hand Auger at 2ft.									
5													

Completion Depth: 2.0 Ft.
Project No.: 2399STL022
Project Name: Solutia
Drilling Contractor: Redi

Water Depth: ___ ft., After ___ hrs.
___ ft., After ___ hrs.
___ ft., After ___ hrs.
Logged by: Tim Hicks

URS Greiner Woodward Clyde

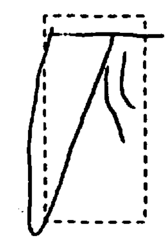


Please explan

Specimen Information

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	LL	PI	Length (in)	Diameter (in)
20.4	106.3	88.4			2.959	1.886

Description and/or Classification: ML, brown slightly to nonplastic SILT, trace f. sand



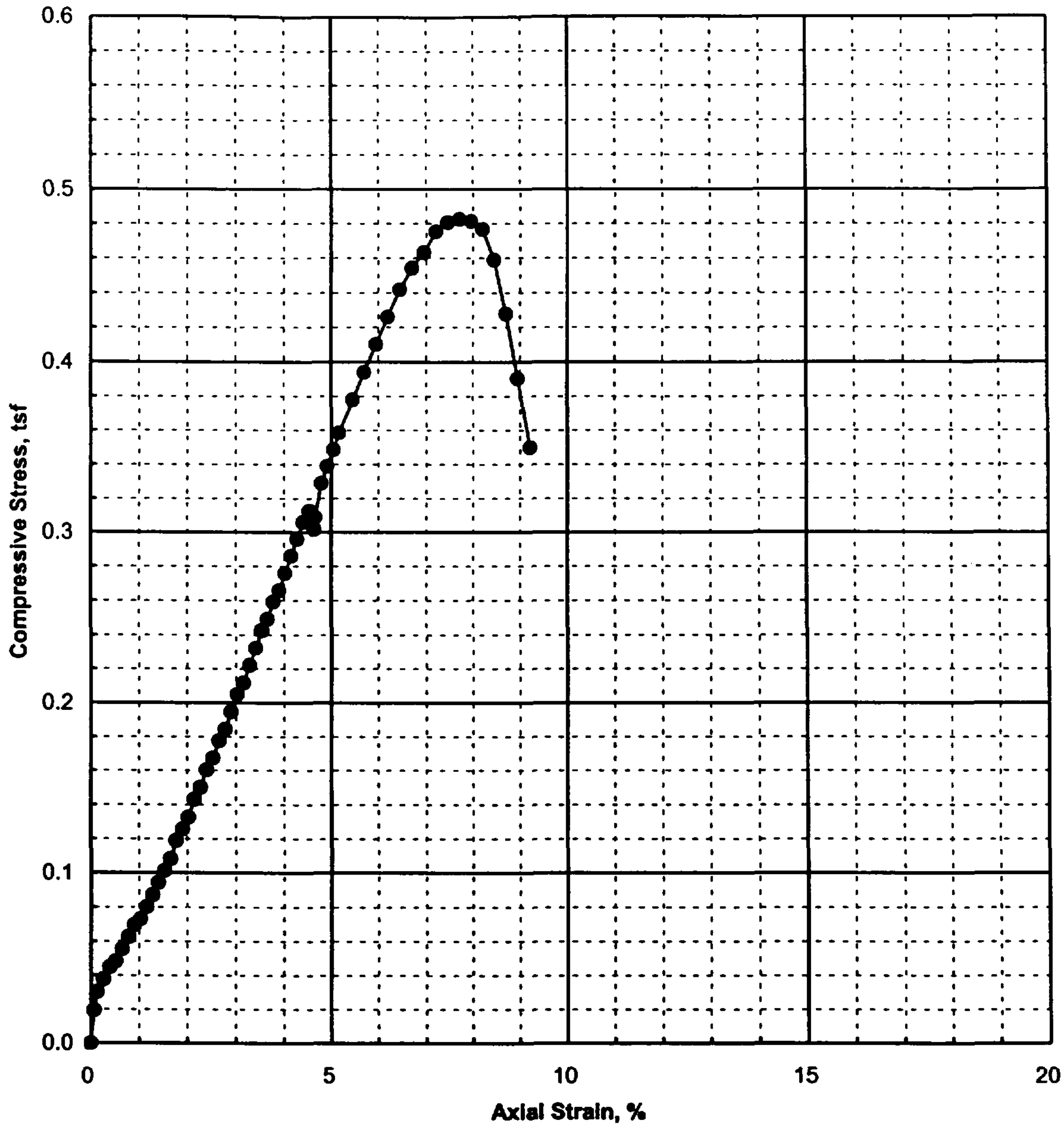
FAILURE SKETCH

Tested by: BB
Test Date: Nov-18-99
Reviewed by: MI

Test Summary

q_u (tsf)	Strain to Peak (%)	Strain Rate (%/min)
0.52	3.16	1.00

Project No. 23-99STL0022.01	SOLUTIA	UNCONFINED COMPRESSION TEST Boring: GB-1 Sample: A Depth:4.35-4.7	November 1999
URS Greiner Woodward Clyde			



Specimen Information

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	LL	PI	Length (in)	Diameter (in)
28.2	115.0	89.7			5.862	2.874

Description and/or Classification: ML, brown slightly to nonplastic SILT, trace f. sand

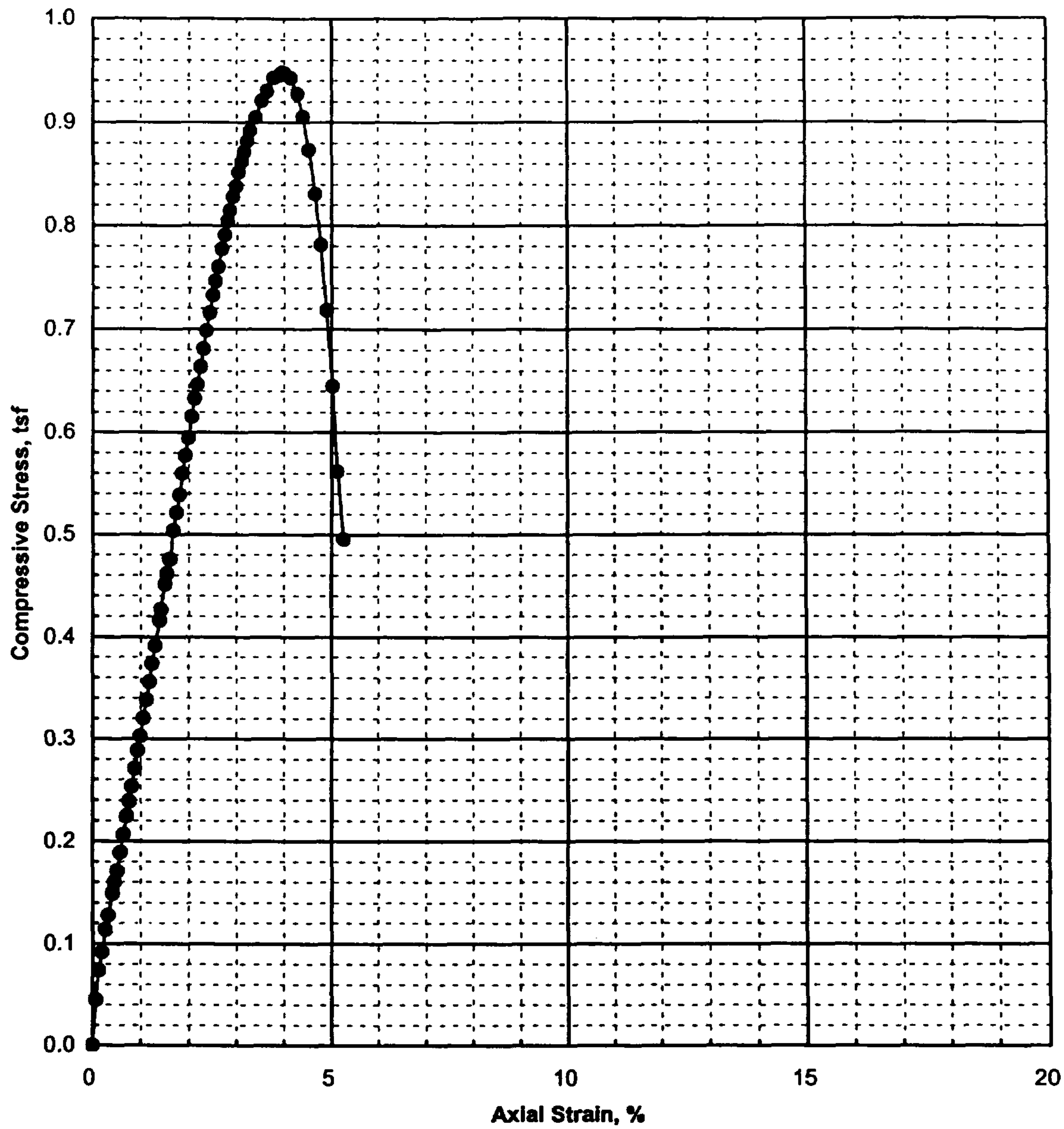
Tested by: BB
Test Date: Nov-17-99
Reviewed by: [signature]

Test Summary

q_u (tsf)	Strain to Peak (%)	Strain Rate (%/min)
0.48	7.70	0.74

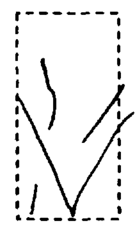
FAILURE SKETCH

Project No. 23-99STL0022.01	SOLUTIA	UNCONFINED COMPRESSION TEST Boring: GB-1 Sample: A Depth:6.45	November 1999
URS Greiner Woodward Clyde			



Specimen Information

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	LL	PI	Length (in)	Diameter (in)
22.6	116.0	94.7			6.006	2.873



FAILURE SKETCH

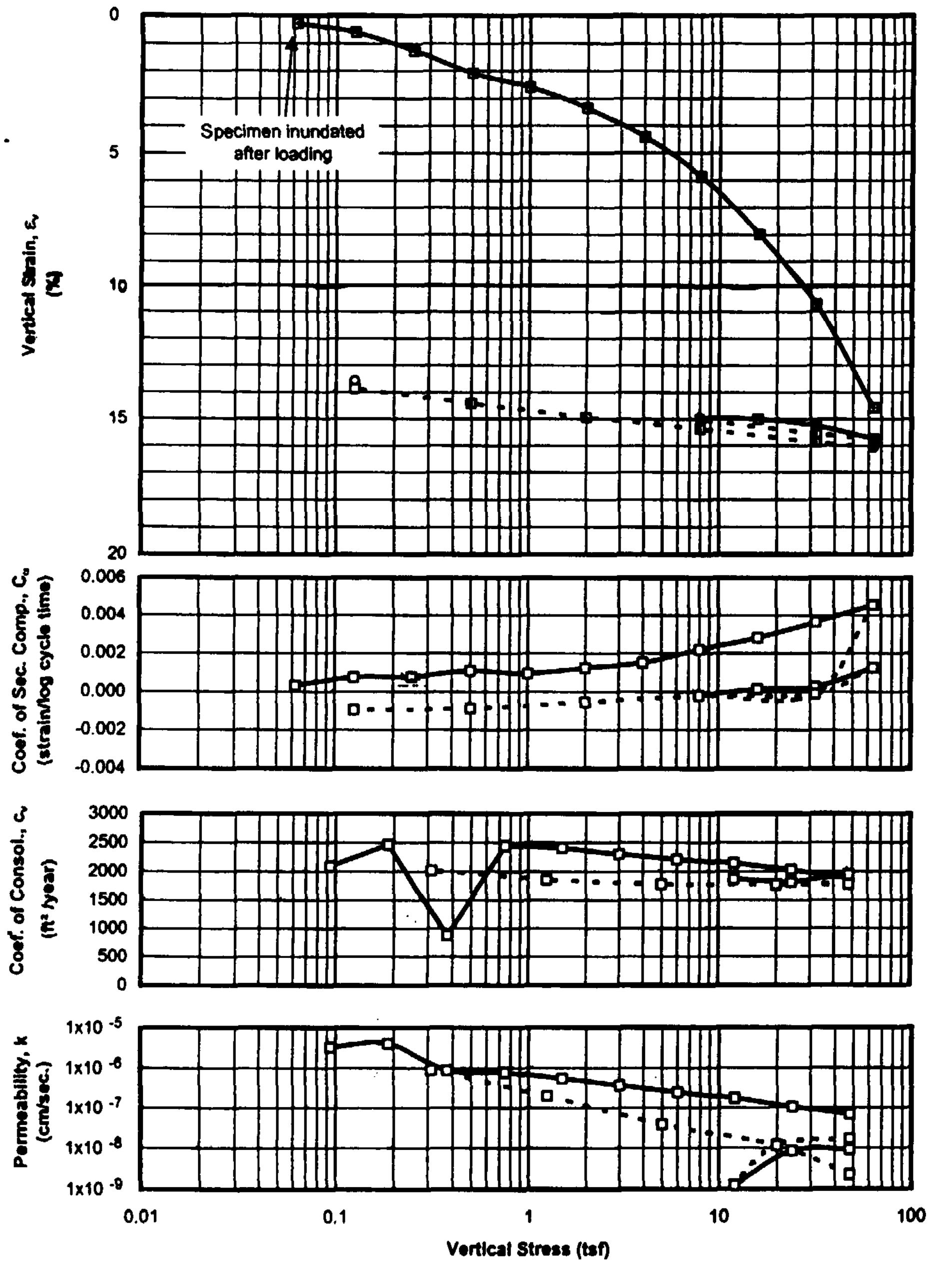
Description and/or Classification: ML, light brown s-np SILT, trace clay; top 1" CL, dark brown silty CLAY.

Tested by: BB
Test Date: Nov-29-99
Reviewed by: [signature]

Test Summary

q_u (tsf)	Strain to Peak (%)	Strain Rate (%/min)
0.95	3.96	0.73

Project No. 23-99STL0022.01	SOLUTIA	UNCONFINED COMPRESSION TEST Boring: GB-2	
URS Greiner Woodward Clyde		Sample: A Depth:1.35	November 1999



SAMPLE INFORMATION

Boring:	GB-1
Sample:	Spec C
Depth:	7.55 feet
Elevation:	
Type:	3-inch thin wall tube
	ML, brown nonplastic SILT, trace f. sand

SPECIMEN INFORMATION

(NOTE: Initial and final states refer to beginning and end of test)

Initial height:	0.61	inch
Diameter:	2.50	inch

Initial water content:	32.3	%
Initial total unit weight:	113.9	pcf
Initial dry unit weight:	86.1	pcf
Initial void ratio:	1.000	
Initial degree of saturation:	89	%
Final water content:	29.6	%
Final total unit weight:	122.9	pcf
Final dry unit weight:	94.8	pcf
Final void ratio:	0.818	
Final degree of saturation:	100	%

(assumed specific gravity = 2.76)

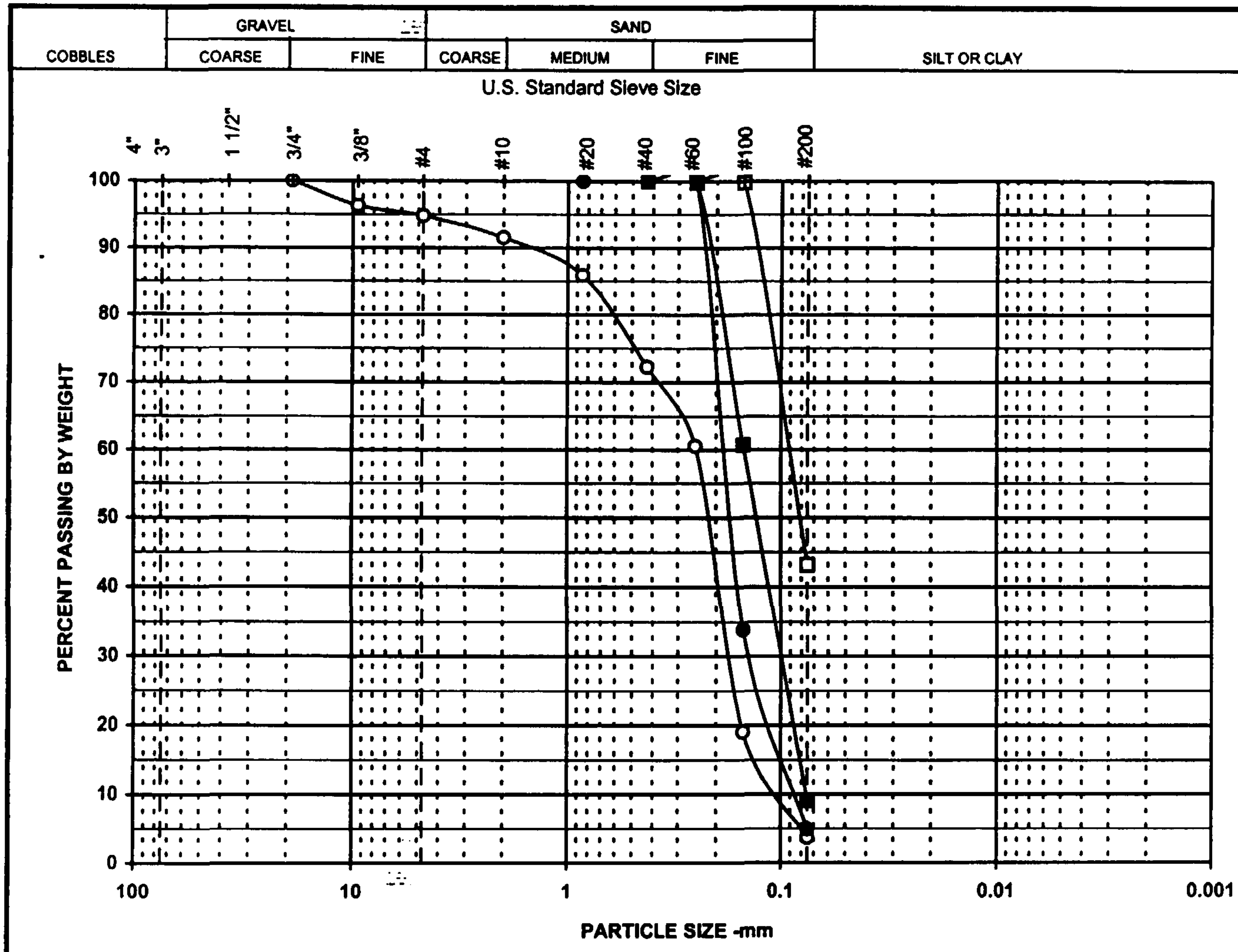
TEST SUMMARY

Construction Method:	Casagrande (Log)
Estimated preconsolidation stress (tsf):	12.8 (Range: 10.9 to 15.3)
Estimated in situ effective overburden stress (tsf):	
Compression Ratio (strain per log cycle stress):	0.128
Compression Index (void ratio per log cycle stress):	0.256
Swell Ratio (strain per log cycle stress):	0.008
Swell Index (void ratio per log cycle stress):	0.016
Recompression Ratio (strain per log cycle stress):	0.012
Recompression Index (void ratio per log cycle stress):	0.024
Remarks:	

LEGEND: ☐ End of primary O End of Stage ——— Loading ------- Unloading

Test Date: 11/17/99 Tested By: GET Checked By: gl

	Solutia	ONE DIMENSIONAL CONSOLIDATION TEST Boring: GB-1 Depth: 7.55 feet
URS Greiner Woodward Clyde	Project No. 23-99STL0022	November 1999 Fig.



SYMBOL	DESCRIPTION AND REMARKS
□	dark brown silty f. SAND.
■	brown f. SAND, trace silt.
○	dark brown m-f SAND, trace gravel, c. sand, silt.
●	brown f. SAND, trace silt.

Symbol	□	■	○	●
Boring	GB-1	GB-2	GB-2	GB-3
Sample				
Spec				
Depth	14-15.5	9-10.5	29-30.5	19-20.5
% +3"				
% Gravel			5.2	
% SAND	56.8	90.9	91.1	95.2
% FINES	43.2	9.1	3.7	4.8
% -2μ				
Cc		1.0	1.2	1.2
Cu		2.0	2.3	2.1
LL				
PL				
PI				
USCS	SM	SP-SM	SP	SP
w (%)	36.6	25.5	22.1	26.9

Particle Size	PERCENT FINER			
(Sieve #)	□	■	○	●
4"				
3"				
1 1/2"				
3/4"			100.0	
3/8"			96.3	
4			94.8	
10			91.5	
20			85.9	100.0
40	100.0	100.0	72.2	99.9
60	99.9	99.8	60.6	99.7
100	99.8	60.7	19.1	33.9
200	43.2	9.1	3.7	4.8

PARTICLE SIZE DISTRIBUTION

Solutia

Project No. 23-99STL022	November 1999	Figure

URS Greiner Woodward Clyde

Siev1.xls 11/30/1999

PROJECT:	Solutia					
PROJECT NO.:	23-99STL0022	Initial height:	0.613 inch		Final height:	0.554 inch
BORING:	GB-1	Initial water content:	32.3 %		Final water content:	29.6 %
SAMPLE:	Spec C	Initial dry density:	86.1 pcf		Final dry density:	94.8 pcf
TEST:	C99216	Initial total density:	113.9 pcf		Final total density:	122.9 pcf
DEPTH, feet:	7.55	Initial saturation:	89 %		Final saturation:	100 %
BY:	GET	Initial void ratio:	1.000		Final void ratio:	0.818
TEST DATE:	11/17/1999				Final strain:	9.8 %

EQUIPMENT:

Load Frame No.: 5

Ring Diameter: 2.5 inch

SPECIMEN DESCRIPTION: ML, brown nonplastic SILT, trace f. sand

G	LL	PL	PI
2.76		np	

Load No.	Load (tsf)	d_{100} (inch)	t_{100} Strain (%)	t_{100} Void Ratio (-)	Final Strain (%)	Final Void Ratio (-)	c_v (ft²/year)	C_α (strain/logt)	Constrained Modulus (tsf)	Permeability (cm/sec)
1	0.063	0.0017	0.277	0.995	0.345	0.994	89.22	0.0003	22.56	1.19E-07
2	0.125	0.0037	0.602	0.988	0.857	0.983	2086.38	0.0007	19.26	3.27E-06
3	0.250	0.0078	1.273	0.975	1.511	0.970	2467.32	0.0008	18.63	4.00E-06
4	0.500	0.0128	2.093	0.959	2.371	0.953	871.77	0.0011	30.47	8.63E-07
5	1.00	0.0160	2.610	0.948	2.905	0.942	2440.00	0.0009	96.78	7.61E-07
6	2.00	0.0206	3.359	0.933	3.832	0.924	2407.63	0.0012	133.40	5.44E-07
7	4.00	0.0271	4.410	0.912	4.911	0.902	2301.41	0.0015	190.31	3.65E-07
8	8.00	0.0360	5.862	0.883	6.533	0.870	2207.57	0.0022	275.50	2.42E-07
9	16.0	0.0490	7.994	0.841	9.213	0.816	2144.66	0.0028	375.26	1.72E-07
10	32.0	0.0657	10.708	0.786	11.603	0.768	2031.05	0.0036	589.49	1.04E-07
11	64.0	0.0893	14.564	0.709	15.759	0.685	1871.59	0.0046	829.93	6.80E-08
12	32.0	0.0955	15.562	0.689	15.531	0.690	1796.95	-0.0001	3208	1.69E-08
13	8.00	0.0922	15.023	0.700	14.940	0.702	1771.15	-0.0002	4455	1.20E-08
14	16.0	0.0920	15.005	0.700	15.050	0.699	1868.95	0.0001	45734	1.23E-09
15	32.0	0.0936	15.254	0.695	15.314	0.694	1809.76	0.0002	6429	8.49E-09
16	64.0	0.0966	15.751	0.685	16.073	0.679	1950.94	0.0013	6443	9.14E-09
17	32.0	0.0974	15.884	0.683	15.856	0.683	1778.30	-0.0001	24135	2.22E-09
18	8.00	0.0943	15.367	0.693	15.306	0.694	1775.23	-0.0002	4647	1.15E-08
19	2.00	0.0916	14.938	0.702	14.766	0.705	1778.33	-0.0006	1400	3.83E-08
20	0.500	0.0884	14.412	0.712	14.070	0.719	1855.80	-0.0009	285.14	1.96E-07
21	0.125	0.0850	13.863	0.723	13.580	0.729	2015.63	-0.0009	68.20	8.92E-07

Where is the hydrogeology stuff. (Page 5-8)
- Depth to GW
- GW Flow directions

What is the depth of the containment cell - how high

What about monitoring wells down-gradient of containment cell?

Could Solutia lower the water table?

Where is the GW data

Cap design ??